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October 2, 1915

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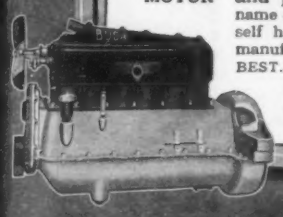

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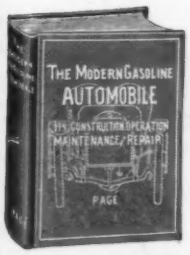

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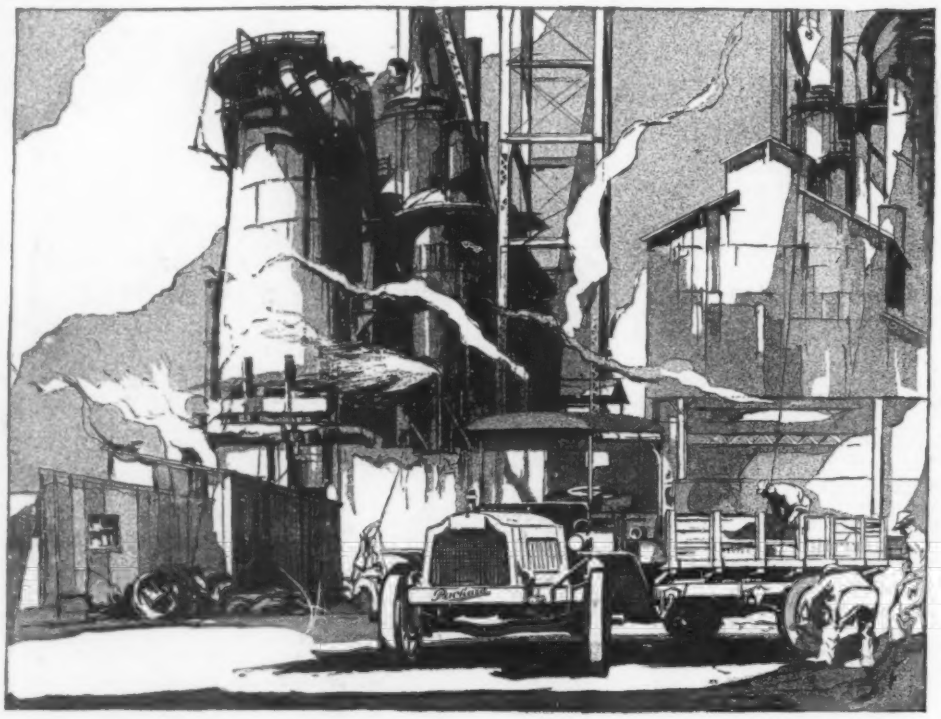

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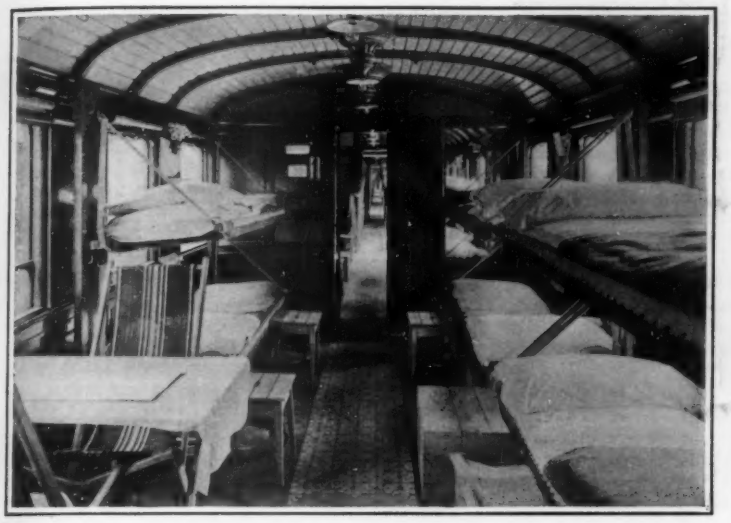

Interior of a Swiss hospital car

Supply car of the hospital train

The Exchange of Severely Wounded Prisoners

WHEN Switzerland mobilized her army on August 1, 1914, the special trains which had been placed at the disposal of the sanitary service of the army were also put in readiness. While they have fortunately up to the present not been required by the country's own army, these trains have been made another accessory of the great humanitarian work which Switzerland has undertaken on behalf of her belligerent neighbors, that is to say, they are being used for the transport into their respective homeland of wounded German and French prisoners of war—those unfortunate men who are maimed and injured in such a degree that they will never be able to return to the fighting lines again.

Long before the outbreak of the war, Switzerland had seen to it that there was a sufficient number of railway carriages which would be suitable for the transport of the wounded in times of war. Shortly after the Franco-German war, on the occasion of the Autumn session of the Swiss Council, a motion made by a prominent Swiss, Dr. Rusch, was accepted, according to which the Swiss railways were to construct their railroad carriages in such a way that they could easily be converted into military hospital cars. On account of the then following financial crisis in Europe, the very practical plan could not be executed until 1878 when the Swiss Federal Council made it obligatory for the railways to construct all their third-class railroad carriages according to Dr. Rusch's idea. This law was, however, suspended on November 27, 1908, when the Swiss Federal railroads declared themselves willing to have 200 third-class passenger carriages of a new type constructed which could be used for the transporting of wounded soldiers in times of war.

Compared with the old type of cars which only opened front and back, these new carriages have an additional spacious side door on each side which is not visible while the seats are in place but which naturally facilitates the handling of the wounded.

The trains now used for the transport of the wounded have been approved of by the French and German governments and consist of a number of cars which are equipped for those who have to be transported in a lying-down position, also of a number of first and second-class carriages for those who are able to sit, and a luggage van. They travel between Lyons and Constance at which points the exchange of the prisoners takes place. The distance between the two cities requires fourteen hours.

The beds in the hospital cars consist of hand-barrows which are placed on both sides of the car, two above each other. Strong belts attach them to the sides of the carriage. The beds, of which there are fourteen in every carriage, are equipped with a mattress, a pillow, sheets and blankets and are said to have received high praise from the wounded. A bag has been placed above each bed to hold those trifles which a wounded man wishes to have next to him. A flower vase even hangs above every bed and some sympathetic persons see to it that they are duly filled with fresh blossoms for every trip. Under the beds are all the necessary sick-room appliances, glasses, cups, etc. Baskets contain the clean linen and bags are used for the soiled wash. A brightly figured oil-cloth on the floor and prettily colored portières on the door give the carriages a home-like aspect and spacious windows provide an abundance of light and fresh air. A male and a female nurse are in constant attendance in every carriage.

The upholstering of the first and second-class carriages in use for those who can travel in a sitting position is covered with light, washable material. A white traveling pillow is provided for every seat. The physician who accompanies the train and the lady representative from the Red Cross have each a small, first-class compartment at their disposal. The luggage car contains large linen closets and cupboards with dishes and glasses, wash basins, special receptacles for water, and all other requisites.

Coffee, milk and lemonade are given to the poor sufferers during the trip. In order to avoid any possible annoyance of the travelers, all gifts intended for them have to be handed over to the representative of the Red Cross, who then looks after the distribution of them. Special little bags of colored texture are filled with these contributions and are given to the soldiers as they leave the train at their destination.

As soon as the train reaches an end station the beds are freshly covered and thus fitted up again with clean things, the carriages receive the wounded prisoners of the other nation to take them back to their native land. Kind-hearted co-workers of the Red Cross have undertaken to provide many of the above mentioned extra furnishings and little things which give the cars a cheerful aspect, while the cleaning and decorating of the carriages, putting up of beds and looking after supplies generally is entirely attended to by voluntary helpers under the supervision of the constantly active wife of the chief physician of the Swiss Red Cross, who has earned special praise for constant and never-tiring efforts on behalf of the noble undertaking.

The Progress of Library Service

THAT the prime function of a public library is to serve the public is an idea of comparatively recent date. This anomalous fact impresses itself upon the mind of anyone who reads the chapter of the last Report of the Commissioner of Education, in which Mr. George B. Utley reviews the library activities of the country during the last fiscal year. Considering the respectable age which scores of our public libraries have attained, it is indeed startling to learn that these institutions have just begun to utilize certain obvious means of making their resources easy of access to the people for whose benefit they are supposed to exist.

Dr. Melvil Dewey has traced the successive stages of accessibility thus: "(1) Books to be consulted by only a favored few; (2) by any who paid the fee; (3) freely by all, but no book to leave the building. Then came loaning: (1) To the favored few; (2) to those who paid the fee; (3) and then this splendid modern conception of free as air or water to all. Now we are in the third stage of branch stations and deliveries by wagons, motors, messengers, express, or mail. The new parcel post greatly stimulated the bibliothecal imagination."

Although branch libraries are no novelty, they have lately developed in many ways. Branches and deposit stations have been established in schools, manufacturing plants, park field houses and playgrounds, department stores, fire and police stations, suburban drug and grocery stores, Y. M. C. A. and Y. W. C. A. buildings, institutional churches, and elsewhere. In the city of Cleveland there are 547 such agencies for placing books at the disposal of the people, while Seattle has 496, and Portland, Ore., no less than 908 (scattered over the county).

The public libraries of St. Paul and Wilmington, Del., have inaugurated the plan of delivering books by messenger, at a cost to the borrower of five cents a volume. The St. Louis Public Library, among others, now delivers books locally by parcel post, the borrower paying the postage by a deposit made in advance.

The variety of service rendered by public libraries is growing apace. Many libraries now lend both lantern-slides and lanterns. A free lantern-slide bureau has recently been organized by the extension division of the University of Minnesota. The University of Wisconsin is about to form a library of educational moving-picture films to lend to schools and social centers throughout the State. The public library at Los Angeles has a sound-proof music room, equipped with pianos, where persons may try music before purchasing from the music stores. Numerous libraries lend music rolls, graphophone records, material for reflectoscopes, etc.

It is notable that from 60 to 75 per cent of those who patronize our large city libraries are either foreign-born or the children of foreigners. The leading library commissions send out traveling libraries in nearly every European language, while the principal city libraries have large collections in foreign languages. Thus, the Buffalo Public Library has about 15,000 volumes in Polish. The Cleveland library has special collections in seventeen languages. The first Chinese library in the United States has its headquarters in Chicago.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Revolutionizing Naval Construction

FROM time to time the public press announces the success of an experimentalist who has produced a small, compact and cheap device which is destined to "revolutionize all naval construction and relegate existing battleships to the junk heap." In due course, following this announcement and after the local representative has cajoled the necessary appropriation out of Congress, the device is built, tested and, more often than not, is found to be an ignominious and more or less costly failure.

The up-to-date navy of to-day is the result of a long process of evolution, in the development of which the very best brains of the country, civil and military, have been employed—to say nothing of millions of public and private capital. The battleship, the battle-cruiser, the scout, the destroyer and the submarine have all passed through the fiery ordeal of theoretical investigation and practical tests upon the high seas. At the head of the list and representing the first and last arm of defense of a maritime country is the battleship; huge, complicated, and costly, it is true, but representing to-day "the best we know how" in the matter of naval attack and defense.

All down the line of modern naval development it has been evident that the idea of producing some small and cheap instrument of destruction, which, at a blow, would wipe out the costly battleship entirely, has been particularly attractive to the man with an inventive turn. Whenever anyone has appeared with an all-destroying device which, on the face of it, has seemed to give some promise of success, he has been dealt with most generously in the public press and (if there were any plausibility whatever in his claims) in the technical press also, and in both he has found a ready hearing and has been given most liberal space.

There are many, as they read these lines, who will recall the advent of the little torpedo boat with its diminutive Whitehead torpedo, and how its appearance was heralded as marking the doom of the battleship of thirty years ago. But the torpedo boat found its answer in the torpedo boat destroyer, a larger edition of itself, swift, able, well-armed, and because of its superior size and speed, capable of running down and sinking at will a whole fleet of the supposedly-invincible torpedo boats. And then, as the destroyer grew in size, and the range of the automobile torpedo with which it was armed was increased, it was noised abroad once more that the great battle ship was doomed. But in this critical hour Armstrong brought out his high-velocity rapid-fire rifle; and forthwith every battleship carried a heavy secondary battery of these guns, sufficient, in connection with the searchlight, to detect and sink the destroyer before it could get within effective range.

Next in order among the annihilators, and following the development of high explosives, came the so-called dynamite gun, big of calibre and capable of throwing so many hundred pounds of high explosive in a single shell against distant battleships or fortifications. Here was an undoubted revolutionizer of naval and military conditions. Battleships were to be sunk by a single successful shot, and a few torpedo shells were to suffice to disrupt a whole modern fortification and scatter its heavy guns as chaff is blown before the wind. The system had its wartime trial at Santiago on one dark night, when the "Vesuvius," armed with three of these torpedo guns, steamed in and threw her supposed death-dealing shells against the ancient fortifications guarding the entrance to Santiago harbor. The results were amusingly small—and so the torpedo gun went the way of all previous revolutionizers.

And then came the submarine, with its promise of absolute annihilation for the fleets which float upon the surface. Even so great an authority as Sir Percy Scott announced that these craft marked the doom of the battleship and indeed of the big ship of any kind. Nevertheless, after twelve months of warfare, and in spite of the fact that the most modern types of submarines have swarmed the seas, the fleets of Great Britain and Germany are still intact and destroyers and battle cruisers roam the high seas with immunity. The officers and men of the destroyer flotillas, indeed, pronounce submarine hunting to be the most exhilarating sport imaginable.

Greatest of all revolutionizers was to be the dirigible. Reams of good paper, gallons of printers' ink have been consumed in predicting the havoc which would be wrought by these ships of the air whenever the accident of war gave them the necessary license. Well; the war has come, the German dirigible has had a fair field and no favor, and the results have been what? The destruction of not a single fortress, the dismounting of not a single gun, the killing so far as is known of not a single military man, and—the slaughter by night and by stealth of helpless women and children and the setting upon the military reputation of a great nation of the stain of a needless and, from the military standpoint, utterly useless cruelty, which will remain there as long as the page of history endures.

No, there is no such thing as the revolutionizing of naval construction. The law of naval growth is the law of an orderly technical development in the hands of intelligent men, proceeding from the lessons and facts of the past to the new and successful accomplishments of the future.

The latest destroyer of destroyers and revolutionizer of naval construction is to be a gas-driven submarine of markedly attenuated proportions which its inventor, Mr. Henry Ford, or Prof. Parker believes will do away with the battleships and relegate existing navies to the scrap heap. Maybe; but it must be remembered that a submarine which, in the submerged condition, exhausts the products of combustion into the water, will leave behind it at the surface a foaming trail of bubbles much larger and therefore much more conspicuous than that which marks the track of a torpedo and enables any swift ship to avoid it by a quick turn of the helm. Unless Mr. Ford has devised some way of causing his gas-driven submarine to run without leaving a foaming streak of bubbles at the surface to indicate its presence, he has sacrificed that very invisibility which makes the electric-driven submarine such a terrible menace to any slow-moving merchant craft that comes within its radius of action.

Stefánsson and New Arctic Land

OF great moment to the world of science is the thrilling message that has come out of the wilderness of the far north from Stefánsson, the explorer, at a time when the universal opinion was that he and his brave comrades had perished somewhere in the icy wastes. After delivering his message at one of the outposts of civilization, Stefánsson has again faced north, once more to be lost to the world of the living for many months, perhaps even years, in order that he may carry on the work of exploring the new land which he stated in his message had been discovered.

The history of the Stefánsson expedition is a thrilling story of the triumph of dogged determination over the most overwhelming misfortunes and defeats. His first and greatest setback was when the "Karluk," the largest and most important vessel of the expedition, was locked in the ice fields, and subsequently sank some seven months after setting out from Victoria, B. C. But the explorer was not to be denied, and forthwith set out with fewer men and humbler equipment to accomplish that which he had originally planned. The lost "Karluk" had been depended upon to carry the expedition for a considerable portion of the journey, but with the vessel eliminated the entire distance had to be covered afoot.

The equipment of Stefánsson and his comrades on their long and exceedingly perilous journey northward from Martin's Point, over the thin ice, consisted of a single sled and dog team, about 1,300 pounds of baggage and supplies, two rifles, and 300 rounds of ammunition. Stefánsson depends upon his gun to supply his camp, and he believes that to withstand successfully the rigors of the north a white man must live and dress after the fashion of the Eskimo. This trip of over 700 miles has proved both his theory and practice to be correct.

The eventful expedition is told in detail by Dr. Herbert J. Spinden, Member of the Explorers' Club and Assistant Curator in the Department of Anthropology of the American Museum of Natural History—who, incidentally, attended Harvard College with Stefánsson—in an article entitled "Stefánsson's New Found Land," appearing elsewhere in this issue.

Dr. Cook as an Object Lesson

IN a book published last year under the title, "Mount McKinley and Mountain Climbers' Proofs," Mr. Edwin Swift Balch undertook to show that there was no inherent improbability in Dr. Frederick Cook's claim to have been the first person to attain the summit of this highest North American mountain. He makes out a rather plausible case in favor of the opinion that all four of the principal partial or complete ascents of the mountain have been described accurately, in the main, by the successive climbers; and while it is impossible to prove beyond dispute that Cook reached the summit in 1906, it is equally impossible to prove the contrary.

It will be recalled that in his earlier book, "The North Pole and Bradley Land," Mr. Balch adopted a similar line of argument in behalf of Cook's polar claims. The doctor certainly advanced no irrefragable proof of having reached the pole, but his opponents have been no more successful in proving that he did not. It is timely to mention, however, that the recent Crocker Land Expedition appears to have helped demolish Cook's story by proving the non-existence of Crocker Land, which Peary only claimed to have sighted in the distance, but which Cook described in detail as having been seen by him at close range. In the book last mentioned, Mr. Balch lays great stress upon this description of Crocker Land, pointing out that a confirmation thereof by other explorers would fairly rehabilitate the doctor's reputation.

In the current number of the *Scottish Geographical Magazine* there is an authoritative and favorable review of Mr. Balch's book on the Mount McKinley ascents, in the course of which the reviewer makes some illuminating statements as to the attitude of British geographers toward Cook. Besides dwelling on the "exaggerated and breathless language" of his writings in general, the reviewer says of Cook's account of the Mount McKinley ascent: "His book has been prejudiced to British tastes by the frantic and screaming language printed under the photographic illustrations. Nevertheless the record of his work is of an heroic effort or feat, carried out with brains and pluck through immense toil, suffering, and endurance, and it is hard to think that such a man is a conscious faker or fraud."

That a lurid and sensational literary style is calculated to awaken distrust as well as repugnance in the minds of many readers is a fact that British critics never tire of pointing out to American writers of a class still numerous, though less so, we hope, than formerly. The career of Cook affords an object lesson. He has to his credit some unquestionable achievements in Arctic and Antarctic exploration, as well as in mountaineering. He has written voluminously, and his writings are by no means devoid of merit from a literary point of view. His book, "Through the First Antarctic Night," giving an account of the "Belgica" expedition, to which he was attached as surgeon and anthropologist, presents the "atmosphere" of high latitudes with a vividness that has hardly been rivaled. Yet he has an unfortunate tendency in all his writings to discredit himself by a turgid style that inevitably throws doubt upon his sincerity.

The Cowardice of Brave Men

MEN in the trenches, now quite used to the war game, have been described as feeling "jumpy"—the sort of affliction that used to be called "mauseritis." Here is a state of mind not necessarily blameworthy, nor even unsoldierly; the bravest have experienced it. The feeling is given various names: As when a young nobleman was sent to the hospital suffering from "heart paralysis." Being immature, a mere youth, his heart, in fact his whole body, was undeveloped—a man in spirit, but not yet in body. Being so conspicuous a figure it was up to him to display the supremest courage; and of course, he made good. All the same there was a profound shock to his physical organism; and something had to evidence that shock. His soul was strong and brave; but his physical being, with its subconscious will-to-live, was afraid; and no shame to it or to its princely owner.

Why should men get equivocal about fear on the battlefield; why not frankly call it that and not "nerves" or some like foolishness? The courage lies all in going ahead despite the fear. The sublimest courage is the "two in the morning" sort, when one's physical condition is at its lowest ebb. And the wonder is, just that kind of courage is now being so magnificently and so lavishly displayed all along the battlefronts, where much of the fighting is done at night. All soldiers are likely to be afraid until they get used to warfare. This has been so of many famous commanders—Augustus, who won at Actium, Turenne, Napoleon, Ney. "A coward is he," declared the bravest of the brave, "who boasts he never was afraid." Demosthenes talked fight aplenty; but he ran away from his first engagement, as did also Cicero.

Notes on the War

The Kiel and the Cape Cod Canals.—Since the opening of the Cape Cod Canal nearly 3,000 vessels have passed through this waterway, including several Government ships. Thus, the submarines K-5 and K-6 made the passage by way of the canal from Boston to Newport at the rate of 11 miles an hour—a Government test which must be looked upon as most successful. The eight-mile trip through the canal was made in 45 minutes, and by using this passage the submarines saved sixty miles of distance and avoided much rough weather. The Kiel Canal was built by the Germans at a cost approaching $100,000,000, mainly for strategic purposes; yet it is a fact that the reduction of distance between the German base in the Baltic and the North Sea by this canal is little greater than the gain to the American fleet, which would result from the enlargement of the Cape Cod Canal to accommodate our battleships, between those two important strategic centers, Newport and Boston.

Cast Iron Shells.—In answer to a correspondent asking why the cheaper cast iron shells are not used in place of steel shells, *The Engineer* of London has this to say: In the first place, where shrapnel is concerned, the number of bullets is reduced because the walls of the projectile must be made thicker. This is not an objection in high explosive shells, which call for walls thicker than is necessary for strength, but there is danger of cast iron shells developing cracks during manufacture and there would be a risk of such shells bursting in the gun. Another objection is that a cast iron shell is liable to be inaccurate in its flight. The projectile must be in perfect balance with the walls, not only of the same thickness all around, but homogeneous. At the high speed of revolution, the slight difference in weight on one side would cause irregular shooting. The steel shell is machined inside and out, to insure uniformity; but if a shell were cast on a core and the core were not absolutely concentric, the center of gravity would not lie exactly in the longitudinal axis of the shell. Furthermore, the making of a steel shell has been so perfected that such shells can be turned out more quickly than those of cast iron of equal reliability of accuracy. An 18-pounder shell can be completely machined from the bar in forty minutes.

Gun Elevation as a Factor of Range.—The SCIENTIFIC AMERICAN was the first American journal to draw attention to the superior range of the German naval guns, due to the fact that they were so mounted as to be able to elevate to a maximum range of thirty degrees. We pointed out that at the battles off Chile, of the Falkland Islands, and between battle cruisers in the North Sea, the German 8.2-inch gun, because of its superior elevation, was able to reach the British ships when the latter were firing at the great ranges possible to their own heavier ordnance. We are gratified to note that according to a dispatch from Washington, the range both of our naval and military guns is to be increased by a change in the mounting and gear which will add greatly to their effectiveness. The present maximum elevation of our 12-inch coast-defense guns (which means the majority of our seacoast guns) is only ten degrees; and hence their maximum range is 13,000 yards—sufficient to outrange any naval gun at the time the forts were designed. To-day this range is greatly surpassed by that of the modern ships of war which can carry with accuracy to distances of from 17,000 to 21,000 yards. The shelling of Dunkirk, a distance of 22 miles, was done, it is believed, by a 12-inch naval gun firing a 1,000 pound high explosive shell and carried on an improvised mounting.

A Waiting Game.—The great war will be decided on the Western front, either in France and Flanders, or on, or within the German frontier. There has been much talk of this war as being a war of exhaustion. If it should prove to be that, it will be an exhaustion not of munition, not of economic resources, but of men. The vast scale on which this war is being fought prevents it being decided by any one great decisive action—the campaign against Russia by Germany has proved that. The great nations engaged in this war have such vast resources back of them that all talk of defeat through exhaustion is absurd. Defeat will come through lack of men to put into the line. When the fighting line thins out beyond a certain minimum with which it can be held, the enemy will break through, communications will be cut, and the whole line of an embattled nation will be thrown back in defeat. The Allies realize this, and they are fighting their fight upon this basis. The central powers have enormous numbers of men. True; but the Allied powers have a vastly greater number—and the fighting of the war has proved that there is very little to choose in point of bravery between the opposed forces. Hence, the inevitable sequel—the collapse sooner or later, and rather later than sooner, of the central powers for lack of men to put in the fighting line.

Electricity

Effect of Wireless Waves on Organic Life.—Ever since the extensive commercial employment of wireless telegraphy, there have been many who believe that the powerful Hertzian waves seriously affect organic life. In fact, some have even suggested that laws or regulations should be enacted to protect organic life against wireless waves. With a view to determining the extent and nature of the radio waves' influence on organic life and climate, Dr. C. Abel-Musgrave recently asked several questions on the subject to be answered by a number of prominent German scientists. The summary of their answers was that wireless waves have no influence on organic life, nor do they alter climatic conditions, although it is true that certain electrical stresses are capable of accelerating rainfalls.

Electric Oven for Testing Shrapnel.—To facilitate the testing of shrapnel there has been devised a thermostatically-controlled electric oven which is now in use in one of the Government arsenals in Pennsylvania. In the testing of shrapnel shells it is necessary that a temperature of 120 deg. Fahr. be maintained continuously for a period of 24 hours. In the new electric furnace the control of temperature is secured by means of a thermostat which breaks the heating circuit when the temperature exceeds the limit set and again makes it when the temperature has been lowered to the required degree. Arcing across the contact points has been reduced to a minimum by means of a condenser shunted across them. It is claimed that the temperature of the oven in a continuous test of 24 hours did not vary more than one degree.

Economy Effected by Gas-filled Tungsten Lamps— According to the annual report of William Williams, Commissioner of the Department of Water Supply, Gas and Electricity of the City of New York, for 1914, the street lighting bill for 1915 will be $400,000 less than for 1914. A goodly portion of the saving is said to have been effected by the use of nitrogen-filled tungsten lamps in place of the arc lamps. The former are being rapidly introduced all over the city. In fact, before the end of the year it is expected that 15,000 gas lamps will be replaced by the electric incandescent lamps. An interesting comparison between the relative cost of operating nitrogen-filled tungsten lamps and arc lamps is presented in the following figures: 300-watt nitrogen-filled tungsten lamps cost $70.00 each a year to operate, while the 400-watt lamps cost $77.00. The cost of operating arc lamps was $85.00 each; a reduction of $5.00 having been effected in the course of the current year.

A Camera for Recording Meter Readings.—A leading American camera manufacturer has introduced an electrically-lighted camera for the photographing of meter dials. In order to secure a reading with this photographic recorder, it is only necessary to place the camera opening against the meter dial and press a lever, which automatically opens the shutter as well as switches on four small battery-operated lamps that illuminate the meter dials. The exposures are made on a film consisting of opaque paper coated with an emulsion. The side of the paper next to the emulsion is white, so that the developed film clearly shows the meter readings in reverse order. The film is then placed in a special roll stand that is provided with a mirror so that the meter dials will appear in their proper order. By means of this camera it is possible for an electric light company to possess photographic evidence of the meter readings of all its customers. Obviously, records of this nature avoid the possibility of mis-readings, and discourage controversies between the consumers and the lighting company. The camera weighs about eight pounds and its operation is simple.

Flood Lighting vs. Outline Lighting.—Within recent years flood lighting has largely supplanted the older method of outline lighting in the exterior illumination of buildings. Both methods are quite distinct from each other; flood lighting causing any building or structure to stand out as a mass of white or any color against a black sky, while the outline method gives a building or structure the appearance of a simple frame work. Although flood lighting is perhaps the most impressive, it is the cheaper of the two methods. A typical example is presented in the tower of the *Times* Building at Los Angeles, California, which until recently was lighted in outline by some 900 30-watt carbon lamps, making a total load of 27 kw. Substituting this for flood lighting, the present load is but 6 kw. The light is supplied by two sets of four 20-inch nickel parabolic reflectors, each containing a 500-watt gas-filled stereopticon tungsten lamp. The one great objection against outline lighting systems is that they render the structure or building unsightly during daylight. On the other hand, flood lighting does not necessitate the altering of the appearance of the building or structure in any way since the projectors are located on neighboring roofs or houses, out of sight of the passers-by.

Science

Professor Albrecht Penck, one of the world's foremost geographers, was one of eight Germans who accepted the invitation of the British Association to take part in its meetings in Australia in the summer of 1914. Although the war broke out just before the sessions began, the German guests were most hospitably received and attended the meetings as planned. On returning to Europe, however, they were detained in England. Not until the end of the year was Prof. Penck permitted to return to Germany. He has recently published a book recounting his experiences.

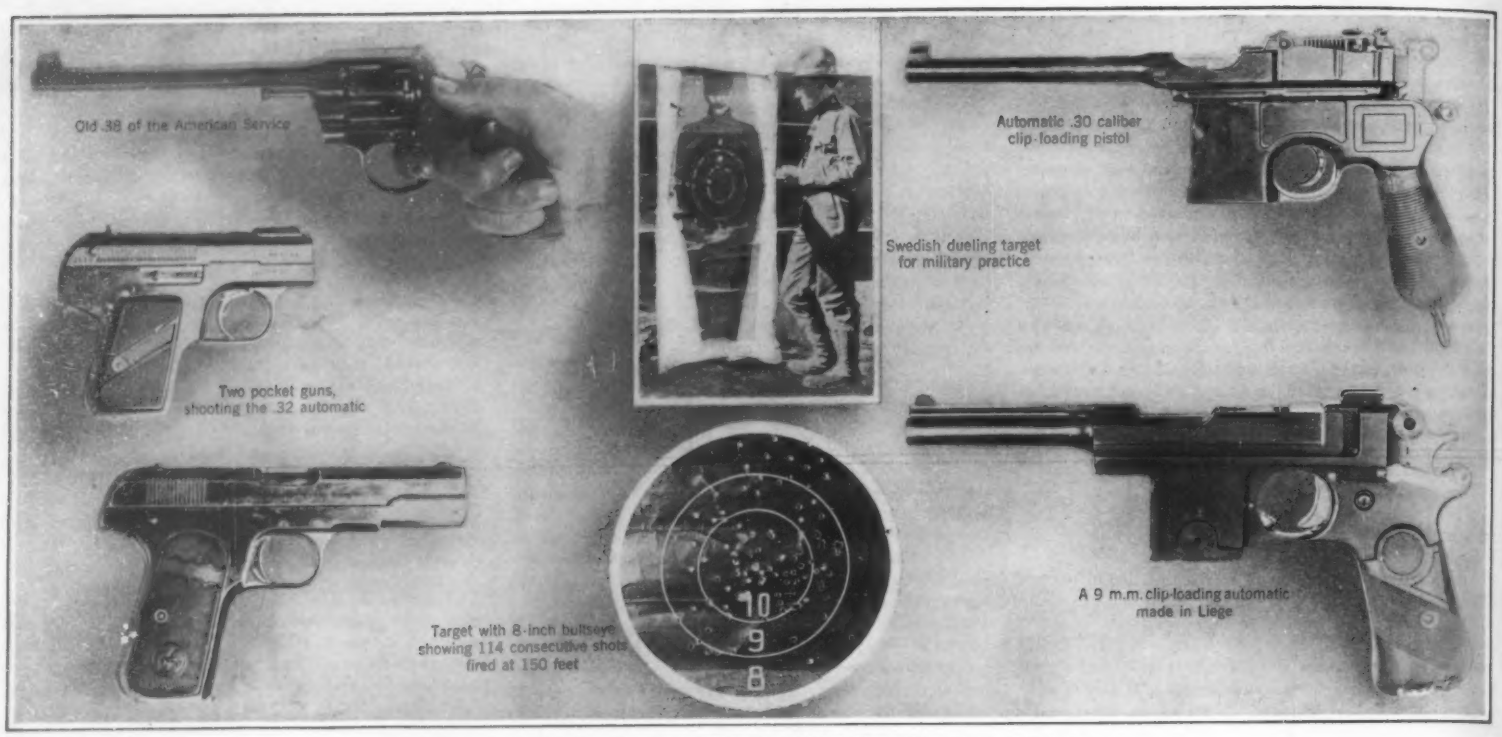
Willow-Herb as a Substitute for Jute and Hemp.—The American consul at Breslau reports that German manufacturers have discovered a substitute for jute and hemp, which have become scarce in Germany, in various species of *Epilobium* (willow-herb), the best fibre being yielded by *E. hirsutum*, while *E. angustifolium* comes second in merit. Both plants grow wild in abundance in Germany (and, we may add, in the United States). The problem of gathering the crop is to be solved by utilizing school children for this purpose during vacations. The Union of German Jute Manufactures is now interested in encouraging the cultivation of this plant, hitherto regarded as a weed.

Plague.—A report of the Public Health Service enumerates twenty-two countries in which this disease occurred during the fiscal year ending June 30, 1915. Its existence at seaports in close proximity to those of the United States keeps the quarantine officers on the alert. Thus it has appeared at Terceira, Azores, from which point immigrants depart regularly for the United States, via St. Michaels and Fayal. The disease has persisted in Cuba, in the cities of Havana and Santiago, and cases have also been reported at Pinar del Rio and Guanabacoa. It also persists in South America, at ports having direct connection with our own, such as Bahia, Pernambuco and Rio de Janeiro; also at Peruvian ports.

Unifying Indian Weights and Measures.—According to *Commerce Reports*, a committee formed in 1913 to consider the question of uniform weights and measures for India has just issued a report advocating that steps be taken in the direction of uniformity so far as these do not involve too radical a change from existing practice. The committee recommends the adoption of the Bengal or Indian Railway system of weights, except in Burma, where it is proposed to keep the present Burmese system in force. The adoption of the Burmese weights would alter existing practice in parts of the United Provinces, in nearly the whole of Madras, and into parts of the Punjab, Bombay, and the Northern Frontier Province. The committee recommends recognizing various local measures of length, area and capacity, standardized so as to bear a definite relation to British measures.

Trachoma Hospitals.—According to the U. S. Public Health Service, the control of trachoma has become a serious problem in this country. It prevails among some portions of the population in at least 34 states, is deplorably common in the mountain districts of Kentucky, Tennessee, Virginia and West Virginia, and is especially prevalent among the Indians. The Public Health Service has attacked the conditions in the Appalachian Mountains by establishing a number of small hospitals, located in converted dwelling houses, and purposely made inexpensive as to equipment and maintenance, in order to demonstrate that such hospitals can be operated annually for a sum any county should be able to raise. They cost about $7,000 a year apiece. Three of these hospitals in Kentucky have treated 1,437 cases of trachoma in the past 17 months. Bulletins regarding the prevention of the disease have been sent to households in the regions in question, visits of instruction have been made to homes, and a total of 120 public health lectures have been given.

The Supplements to the Commerce Reports are a recent addition to the publishing activities of the Department of Commerce of much interest to geographers. These consist of pamphlets, generally somewhat larger than the Commerce Reports themselves, and each devoted to a single country. They are written by American consular officers in the respective countries, and appear at intervals of a few days. Although the bulk of the information they contain is of a commercial nature, they devote a certain amount of attention to political, physiographic, and other features; and the "up-to-dateness" of this information gives it a unique interest to the student of the kaleidoscopic science of geography. It will, perhaps, not be amiss to suggest to the Department that these non-commercial features of both the Commerce Reports and the supplements might well be strengthened, since no other official periodical publication exists through which our consuls abroad can so readily communicate to American readers the latest developments of the countries where these officials are stationed.


Old .38 of the American Service
Two pocket guns, shooting the .32 automatic
Target with 8-inch bullseye showing 114 consecutive shots fired at 150 feet
Swedish dueling target for military practice
Automatic .30 caliber clip-loading pistol
A 9 m.m. clip-loading automatic made in Liege

Various types of military small arms and targets which indicate the efficacy of their fire

The Development of the Army Pistol

How the All-Important Stopping Power Requisite Has Resulted in the Adoption of Large Calibres

By Edward C. Crossman

IN the hands of the average man the pistol is perhaps most formidable when thrown at the enemy. Not that the penetration or the lethal qualities of the arm are greatest when used in this way, but the chances for hitting overshadow all other considerations.

Yet accuracy with the pistol increases wonderfully with the slightest practice—to this fact I call in witness the inability of beginner after beginner to hit a washtub at 10 feet in the start of things, and the later consistent holding of the 8-inch bullseye at 150 feet when the idea of yanking the trigger has been abandoned after sad experience.

With the war degenerated into a desperate struggle at short range for the possession of very undesirable sets of mud-holes, the pistol comes into a field of usefulness from the military standpoint which it has not occupied since cavalry fights were the proper thing.

A large calibred automatic pistol fired at a gentleman jabbing at you with a hungry-looking bayonet in the endeavor to make you share your trench with him, is very likely to abate the nuisance.

In the melee the rifle is too long to be used with the best effect, and a bayonet is no better than its own length plus that of the rifle which holds it. There is no doubt as to just what a bayonet can do. But the ten-shot automatic pistol, fired by a fair pistol shot at attackers at close range, is considered more efficient than the rifle because the time is too short and the rifle too long. Six feet of range terminates the usefulness of the rifle, save as the accompaniment to the bayonet, while, on the other hand, the pistol can be used up to the last gasp, and even should the combat become a hand-to-hand struggle the pistol can still be brought into play with decisive results.

Ordinarily, the author is a scant believer in the efficacy of the pistol, this through considerable experience with one in target shooting and a less happy experience in trying to hit things when he really felt considerably interested in hitting them—such as the question of a square meal, for example. Yet, when the problem is merely one of killing as many men in as short a time as possible, and when the range and the mark make missing almost as difficult as hitting, there is no discounting the superior efficacy of the well-handled pistol. Its high rate of fire, its speedy recharging, the small space needed in which to use it, and the fact that until needed it can be out of sight and out of mind and still instantly accessible, all go to make it a very desirable adjunct to the equipment of the trench-fighting infantryman.

There is no disputing the superior efficiency of the large calibred pistol as compared to the smaller. The modern automatic pistol uses metal jacketed bullets because of the more certain functioning of the smooth, hard bullet through the mechanism. The velocity of the pistol is so low that no attempt to make these metal jacketed bullets "dum-dum" or mushroom will succeed; there being insufficient weight and speed to the small calibre bullet to make them burst open the jacket, however weakened, or split.

Also there is the very minor consideration in these pleasant times that "dum-dum" or soft nose bullets are not allowed in civilized warfare, although lung-corroding gas clouds and flame projectors are quite in vogue.

Because of the proved lack of immediate lethal qualities in the small calibre pistol bullet, and the very urgent need of them in all cases where the pistol can be used with success, the large calibres are the only satisfactory ones. If it is not possible to make a pistol bullet, wrapped snugly in a tough skin of cupronickel or sheet steel, flatten out similar to a lead bullet or mushroom like a game bullet, the only recourse is to use as large a bullet as possible, and accordingly make the resulting perforation as generous as possible.

It is obvious that the main function of the pistol is to immediately dispose of an antagonist before he can do harm to the possessor of the weapon. In his ultimate fate you have little interest if you are killed or in a hospital yourself. It is far better to eliminate the foe as a fighting force, even temporarily than to inflict a fatal wound—fatal hours later but still not immediately disabling. In stopping a man with a pistol, time is the essence of the contract; it is what the other man does the first ten seconds after being hit that determines whether or not the arm is an efficient arm. All of this is because the range is no longer in inches than the ordinary range of the rifle fight is in yards.

Owing to the absolute necessity of immediately eliminating the foe—delivering the crumpling blow of the bullet on one who may be threatening the possessor of the pistol with almost certain death—the United States Government has adopted the .45 calibre with a ponderous 230 grain bullet. The velocity is but 800 feet per second, less than a third that of the army rifle, while the bullet weighs 50 per cent more than that of the rifle. Range, flatness of trajectory, remaining energy at a mile—none of these things count when the mark is but a few feet away.

In the early days of the West the men who carried revolvers for the sake of self-protection unanimously voted for the calibre of .40, or better, usually the .45. Here, too, they had lead bullets, which flattened out at little provocation. But even these bullets did not possess sufficient stopping power, since quite often the stricken one carried the other person to eternity with him by his return fire in the last second of his life.

The last famous gun fight in our territory, the capturing of "Soapy" Smith at Skagway by Reed, saw Reed putting the quietus on the notorious "Soapy," but in turn receiving fatal wounds and both men dying.

Another notorious shooting affair saw the victim, hit repeatedly with bullets from an automatic pistol at short range, swim a number of yards, and climb out on the yacht landing float.

A third, in which one of the most famous American writers was killed, developed the fact that after being hit three or four times with bullets from a small calibred automatic pistol, a .32, he held himself up by gripping the bars of an area railing.

Imagine a man, half-insane from the excitement of the bayonet charge under terrific fire, and possessed, too, of the Berserker rage, being stopped short and put *hors de combat* by any such comparatively mild fire, when men in normal state of mind were not immediately killed from a number of such shots.

Those nations having dealings, friendly and otherwise, with savage folks, become strangely enamored of large calibred pistols. The British, after various dealings with the hill men of India, who consider it manners to rush a camp with curved knives of razor sharpness, evolved a generous bullet of .455 diameter, heavy, and of low velocity for their service revolvers. Their officers went even further, and adopted a double barrel pistol taking either huge slugs or else a number of buckshot. These pistols were usually 20-gauge in shotgun measurement, which in inches is .615 calibre, smooth bored, very often with hammerless ejector and single trigger not unlike the most improved shotgun. When the two barrels were fired and the two huge .61 calibre slugs went on their way, there was usually a very pleasing vacancy in front of the gun.

The United States army abandoned the old single action .45 calibre revolver in the '90's, and adopted a .39 calibre double action revolver. Then came the conquest of the Filipino insurgents, in which the revolver as a weapon was largely employed. The experience of the American soldiers engaged in the conquest was precisely that of the British—namely, the larger the calibre the better the immediate results, which in revolver fighting are the only ones of account. The .38 calibre was voted ineffective, and this gun, like all revolvers, had a pure lead bullet, which would mushroom or flatten quite readily, and which the bullets from the automatic pistols will not do at all.

So there is considerable satisfaction with the present gun of the American forces, the .45 automatic pistol of Browning patent, with its eight shots, its compact form, ease of taking apart, and certainty of function.

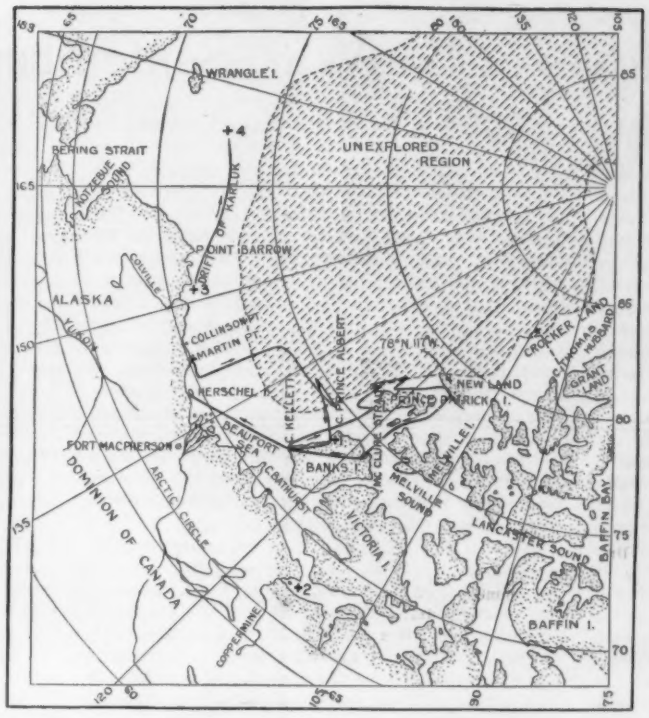
The other nations, lacking the practical experience of the Americans along a western frontier, and that of the British in their various and never-ceasing arguments along the Indian frontier, favor smaller calibres in their pistols than we regard as being practical. The 9 mm. or .36 calibre appeals to them as being enough cartridge for anybody.

The Germans divide their choice between the .30 Luger and the .30 Mauser; the Austrians use the Mannlicher pistol; the French the revolver of .38 calibre; the Spanish, the Swedes, and to some extent the Belgians use the Bayard pistol of 9 mm. or .36 calibre.

None of the nations now at war has adopted the .45 calibre in its automatic pistols, but doubtless they will know better when the war is over.

Courtesy American Museum of Natural History

A couple of Eskimo children



Stefansson's course and new land he discovered

Natives at Prince Albert Sound

Stefánsson's New Found Land

A Résumé of Work Done by the Canadian Arctic Expedition

By Dr. Herbert J. Spinden

Member of the Explorers' Club and Assistant Curator in the Department of Anthropology of the American Museum of Natural History

STEFANSSON has come out of the ice floes of the north with a tale of new found land, and hardly waiting to send word to the world that thought him dead, he has again set face to the north, where nameless mountains and an unguessed shore line await him. This statement means more than the words alone would indicate; it means that victory has been wrung from defeat and overwhelming misfortune, and that when the last story is written, the names of the lost will be joined to a successful undertaking.

It is safe to say that no Arctic expedition has triumphed over as great an initial handicap as that sustained by Stefánsson's party in the tragic destruction of the "Karluk," with the subsequent loss of eleven lives. Arrangements had been completed for Stefánsson to go into the Arctic on his third venture under the joint auspices of the American Museum of Natural History and the National Geographical Society, when the Canadian government expressed its willingness to finance the expedition. The "Karluk," chief vessel of the Canadian Arctic Expedition, sailed from Victoria in June, 1913, fully equipped for three years of scientific work. Both hemispheres had contributed to the scientific staff that embraced experts in several sciences.

Owing to an unusually short summer, the "Karluk" and the two smaller boats of the expedition were unable, in 1913, to reach Beaufort Sea. Perhaps the large vessel kept too far from shore. At any rate the "Karluk" was finally caught fast in the ice about eighteen miles off the mouth of the Colville River. Stefánsson and five of his men had landed to hunt caribou, when a gale tore the floe from the shore and the "Karluk" began a four months' drift to the west. On January 11th, 1914, she sank, after supplies had been placed on the ice.

An advance trail-making party of seven men set out for Herald Island, some forty miles distant, but found open water near shore. Four men were left to guard the supplies, while three turned back. In the meantime a second party consisting of Dr. Mackay, surgeon, James Murray, oceanographer, Henri Beuchat, anthropologist and a seaman, resisted advice and followed the advance guard. They, along with the others who had remained near Herald Island (Anderson, Barker, Brady and King), were lost in a furious gale.

The rest of the party succeeded in making Herald Island and then Wrangel Island on March 12th. Capt. Bartlett and an Eskimo made a dash for the mainland, reached Cape Nome and started the work of rescue. The "King" and "Winge" accomplished the rescue in the following September, after the "Bear" had turned back for lack of fuel. To the eight lives lost on the ice were added those of Malloch, Mamen and Breddy.

The loss of the "Karluk" left the expedition sadly crippled. But the temper of its leader was unshaken, and with humbler tools and fewer men he tried to carry out the first laid plans. The Canadian government responded generously to calls for aid and replaced a large part of the lost supplies. These were sent up on the "Ruby" and only arrived at Herschel Island during the summer of this year. The two smaller boats weathered the winter and proceeded east with open water. The men who were fortunate enough to be ashore with Stefánsson were also spared for active work.

It had been planned originally to establish two principal bases and a number of minor ones. One of these was to be on Banks Land or Prince Patrick Island, from which explorations to the north and west could be conducted with safety and speed. The second base was to be far to the east, in the region of Coronation Gulf. Stefánsson's own work was mostly planned in connection with the northern base, in a quest for the land mass which tidal experts had placed north of Alaska and Siberia in the midst of the Arctic Ocean.

Stefánsson's daring trip northward from Martin's Point was in accordance with his earlier plans, except that it was done afoot instead of aboard ship. Returning March 5th, 1914, from Fort McPherson, where he had gone to get the southern party under way, Stefánsson found the outfit had not been made ready. A delay of two weeks greatly increased the danger and difficulty of over-sea travel. On March 27th the party were only a few miles from shore when nature took a hand, and a blizzard drove them, willy nilly, far to the east and away from the retreating coast line. On April 7th the supporting party turned back and Stefánsson, with two sturdy companions, Storkersen and Ole Anderson, pressed on alone. Their entire outfit consisted of a single sled and dog team, about 1,300 pounds of baggage and supplies, two rifles and 360 rounds of ammunition. It has always been Stefánsson's idea to make his gun supply his camp and to live and dress after the fashion of the Eskimo. His theory and practice have received vindication in this remarkable journey of 700 miles.

Vilhjálmur Stefánsson

The drift continued toward the east, and a course due north was made possible only by heading 10 to 30 degs. into the west. On April 27th they reached 73 deg. north and 140 deg. west, a point about 240 miles from their base. There was much thin ice and the constant sunlight of early summer was making travel precarious. To quote the account in the New York *Times:* "Our work lay to the north and safety lay there also, for there we should be traveling away from summer." But provisions were low and when 74 deg. north latitude had been reached, a course was struck for the northwest corner of Banks Land. Fuel ran out and rations were cut down, but soon an open lead stopped their progress, and in the wait a large supply of meat was accumulated. The drift from wind and current was considerable and a landing was finally made on June 26th, 1914, thirty miles below Prince Alfred Cape, on the west shore of Banks Land.

After waiting in vain for the "North Star" (this boat was then far to the east with the second party) Stefánsson marched to Cape Kellett, where he found the "Mary Sachs" in winter quarters. In February, 1915, he set out again for the north, but again there was delay. Travel conditions on thin ice were poor off Prince Patrick Island owing to a strong southern drift, and Stefánsson was forced to make land. Cape McClintock was reached on June 15th, and, four days later, new land to the north, the exact location being 78 deg. north and 117 deg. west. From this point the trend is northwest and south of east. The new shore was followed eastward for about 100 miles and observations from a height of 2,000 feet, about twenty miles inland, revealed that the new land is at least 150 miles in extent. At no great distance east lies Isachsen Land.

The party returned from its find by a route east of Prince Patrick Island and crossed Banks Land from the Bay of Mercy to the base camp at Cape Kellett. With a new boat, the "Polar Bear," it is hoped to establish the originally planned northern base and pursue the work of exploration. Eskimo live on Banks Land and it will be interesting, indeed, if traces of human habitation or man himself should be found on the new northern land.

(*Concluded on page* 306)

Strategic Moves of the War, September 21st 1915

Capt. Matthew E. Hanna, Recently of the General Staff, U. S. A.

OF all the great battles waged in the eastern theater of war during the past five months, perhaps none has been so full of possibilities as that being fought to the south of Vilna as these notes are written. The Austro-Germans are making another audacious attempt to split the Russian army in twain, and in doing so they appear to be taking desperate chances that they themselves will suffer a disastrous reverse. They are playing for a high stake, and if the reports reaching us are correct, they are playing with an abandon and disregard for a possible Russian counter-offensive unlike anything we have noted in their operations prior to this battle. The situation recalls the last desperate attempt of the Germans before Paris to crown the opening campaign of the war with a decisive victory, only to be defeated by the French in the great battle of the Marne and thrown back to the line they still occupy. We have yet to see whether a similar reverse is to overtake them in the east.

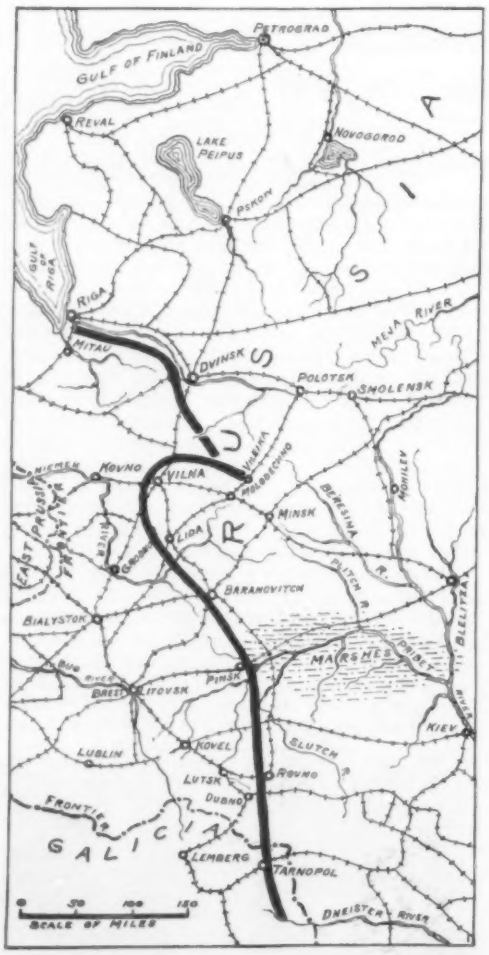
In the stirring events of more than a month preceding and following the capture of Warsaw and the Polish salient, we had become so accustomed to reading each day of new German conquests that the comparative quiet of the past few weeks was becoming tedious, and on all sides we heard prophets saying that approaching winter, German exhaustion, longer lines of communication and renewed Russian strength had brought major operations to an end for this year in this theater. And now the storm breaks with increased violence at an unexpected point, apparently illustrating once more the completeness with which the German General Staff makes its preliminary arrangements for each successive move. If we were forced to express an opinion on the probable outcome of the battle now raging, we would base our conclusions on the past performances of the Germans, and say they probably did not undertake this last drive until they were quite certain they could see it through to a successful termination. This has been characteristic of each move of the Teuton armies from the beginning of the eastern campaign in the opening days of May.

The desperate fighting which followed the capture of Warsaw and lasted throughout the month of August finally subsided as the Russian line was withdrawn from Poland and established with one flank on the Gulf of Riga and the other on the Rumanian frontier. Fighting continued, to be sure, but it was of minor importance although accompanied by further important advances by the Austro-Germans, intended no doubt to prepare the way for the great battle now being fought. The time consumed in rearranging and resupplying the Teuton armies was greatly increased because of the unfavorable railroad conditions. Not only were the railroads much fewer in numbers as compared with the roads nearer the German frontier, but they also had to be rebuilt. The labor thrown on the communication troops of the German armies must have been stupendous, and when all the conditions are known we probably will be amazed that one German blow could follow another with such rapidity.

Distances are so great in Russia that a mere casual glance at the map does not reveal the true railroad conditions, but a closer study of the small scale map accompanying these notes shows some astonishing facts. Consider the triangle formed by Vilna, Minsk and Baranovitch. It is approximately one hundred miles on a side and contains but one intersecting railroad. Compare this with the network of railroads in the state of Connecticut which is but one hundred miles long and fifty miles wide. Or consider the larger area bounded by the railroads joining Baranovitch, Minsk, Bielitza and Pinsk, two hundred miles long by one hundred miles wide at the extreme points, and containing an area of more than 10,000 square miles without a single railroad. Imagine one fourth of the state of Ohio without railroad communications. Block out ten thousand square miles on any railroad map of the United States, note the network of rails in the area outlined, and some conception may be had of the scarcity of rail communications in the part of Russia where fighting is now taking place. Railroads were of prime importance to the comparatively small armies and light ordnance of a generation or so ago, but for an army numbering millions and equipped with the mammoth artillery of today they may be the deciding factor in a campaign.

The Germans probably planned the Vilna campaign some weeks ago. Earlier in the campaign it was possible for them to shift large numbers of troops in a very few days and take advantage of favorable developments at some point of the long battle front, but that can no longer be done. As we review the events of the past three weeks it appears that the Germans have gradually created the opportunity for the Vilna drive. All information points to their having selected the northern wing of the Russian army as the target for their next great offensive move. The success the Russians have had south of the great marsh region indicates that the Germans weakened their forces here to increase their strength in the north. For about two weeks they carried on a vigorous offensive against the Russian lines along the Dvina river from Riga to Dvinsk, the effect of which probably was to draw strong Russian reserves to this region. In the meantime they apparently have encouraged the Russian force in Vilna to hold on to that town while they were bending their lines about the city to the east and the west and forming the bag in which they hoped to catch a large part of the Russian army.

Then the real object of the campaign suddenly became apparent. From three directions they began a powerful drive at the force defending Vilna. The railroad from Vilna to Dvinsk was cut and one avenue for the escape from Vilna was closed. The German cavalry, concentrated in advance for this opportunity, was then pushed ahead and in a few days it had possession of Vileika on the railway from Lida to Polotsk. This left but two rail lines of retreat for the Russians about



Battle line in the East on September 21st

Vilna—via Minsk and Baranovitch. As these notes are written the German cavalry is pushing on to Molodechno and Minsk to close one of these lines, and the German troops west of Baranovitch are making violent efforts to reach and close the other line at that town. Should the Germans succeed at both these points no lines of retreat would be left the Russians other than inferior highways leading towards the marsh region.

Desperate as the Russian position appears to be, relief may come from Russian forces farther to the east. From Polotsk, Smolensk and Bielitza three railroad lines run to the rear of the Germans who have penetrated to Vileika and beyond, and we may be sure the Russians are exerting every effort to strike the Germans a decisive blow on this dangerously exposed portion of his line. If the Russians are strong and quick enough to do this, the final outcome of the battle might be to their decisive advantage.

Complete German success in this battle might mark the beginning of a decisive outcome for the great Russian campaign. Even partial success should be accompanied by material advantages. Between Vilna and the great marshes there probably are at least a quarter of a million Russians, who may be caught in the German net that is sweeping around them. Great as would be the disaster to Russia if even a fraction of this number of men together with the large amount of artillery accompanying the force should be captured, still it would be of but minor importance when compared with the still greater disaster if by chance the German victory should result in splitting the Russian army in twain—the first decisive step towards the total destruction of Russia's armed forces in the field. Once more the Germans appear to be on the verge of doing this. It remains to be seen whether the new leader of the Russian armies is as skillful as his predecessor in eluding the traps set for him by the German leaders.

At the worst, German success in this battle should leave them in possession of the Vilna-Lida-Baranovitch railroad and in position to secure the extension of this line to Rovno. This would be of very great value in the further prosecution of the campaign. What has already been said of the railroad conditions will help to make this clear. With this road in their possession the Germans would have a line parallel to their rear from near Dvinsk to Rovno, a distance of nearly four hundred miles, along which troops could be speedily moved from one portion of the line to the other, and supplies coming on railroads from the west could be distributed. This advantage becomes more pronounced when the disadvantageous railroad situation of the Russians is considered. Before they could have a similar transverse line in their rear they would have to fall back a distance of over two hundred miles to a line running through Dvinsk, Smolensk, Mohilev and Bielitza. Should they remain in front of the Germans on the Dvinsk-Vilna-Baranovitch-Rovno line their supplies on this four hundred mile front would reach them over six railroads with an average distance between railheads of nearly seventy miles.

Should the Germans eventually succeed in capturing Dvinsk and the railroad to Riga, their advantage would be still greater. With winter coming on the necessity becomes greater for looking ahead and planning for a different type of campaign during the extremely cold weather. Should the Germans decide to entrench as in the west, this line of rails in the rear of their trenches will be an asset almost beyond value. Its worth in terms of men and guns cannot be estimated, but it will surely enable the Germans to hold this line with greatly reduced numbers, thus freeing considerable forces for other theaters.

Judging by the rumors that come to us from the Balkans, the Teutons will need in this region all the men they can draw from other fronts. In a Berlin official report the statement was made during the week that German artillery was being employed along the Danube frontier of Serbia. At the same time, Bulgaria has been actively mobilizing her loyal sons from Macedonia. The long predicted march overland through Serbia to Bulgaria and the relief of the Turk seems more imminent than ever before. With Bulgaria and the Teutons allied against Serbia, Rumania and Greece, together with British and Italian troops sent into this theater, a winter campaign of no small magnitude may be fought out in this warmer southern region.

The opening event of such a campaign would be to secure a crossing over the Danube river which forms the greater part of the northern frontier between Serbia and Austria, and the artillery action of the past few days along a considerable part of this frontier probably was for the purpose of preparing the way for the crossing by the German and Austrian infantry. The most direct route to Bulgaria would be across the northeastern portion of Serbia, which is scarcely thirty miles wide, but it is not probable that this route would be used since it lies near the Rumanian frontier, passes through a mountainous region and is not traversed by a railroad.

The most probable line of advance is along the Morava river, which empties into the Danube below Belgrade after passing entirely across Serbia through the city of Nish. The Orient railway follows along the valley of this river through Sofia and Adrianople to Constantinople, and the main purpose of the campaign is to open up this rail route to Turkey. It is one hundred and fifty miles from the Danube to the point where this railroad crosses the frontier between Serbia and Bulgaria, and this represents the minimum distance over which the invaders must advance before they can send ammunition to the struggling Turk.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

American Inventors and Foreign Patent-rights

To the Editor of the SCIENTIFIC AMERICAN:

I have just read with much interest your editorial headed "Inventors Too Cautious," in your issue of the 7th of August. I do not presume to criticize it, except in one point: I have found that American inventors have in many cases lost valuable foreign patent-rights owing to publication of their inventions, not harmful to them in America—indeed doubtless beneficial, as your article shows—but harmful to them when applications for foreign patents have to be considered.

The International Convention, of course, safeguards them in many cases if they apply for their American patent promptly after conceiving the invention, and if they take care to apply abroad within the Convention period. But Americans have become so well accustomed to the latitude afforded them by their own patent-law that it sometimes comes upon them with somewhat of a shock to find that the laws of other countries are not so generous. W. J. T.

London, September 1st, 1915.

A Plan for an Army of Defense

To the Editor of the SCIENTIFIC AMERICAN:

The article in your July 10th issue entitled "A Plan for Increasing Our Military Strength" prompts me to make a further suggestion toward that end.

Let every male employee of the United States Government between the ages of 18 and 45 years, who is physically fit and his work would permit, be required under Civil Service to become a part of the National Guard.

Provide, as suggested in the article mentioned, Regular Army officers as instructors; other officers to be elected on their merit. A chief in a Government department might be a "private" in the guard; but as pay in proportion to their duties would be a feature of the plan, a man's rank would be a matter of financial importance, stimulating his work as a soldier.

The National Guard should be placed on the dignified basis accorded the Army.

If, in addition to the work already operated by the Government, the telegraph, telephone, and even the railway systems in the United States were placed under Government control, a large corps of men would be made available. Thus, it might be unnecessary to maintain our present Army of 90,000 men, although we would still have a body of trained men more than twice that size, at a minimum cost to the United States. This, also, without the giving up of other professions to elective or compulsory military training.

Cristobal, C. Z. A. G. S. MACQUEEN.

Waterproofing Concrete

To the Editor of the SCIENTIFIC AMERICAN:

I have been very much interested in reading in your issue of June 26th a letter from Mr. L. G. Hall in reference to waterproofing of concrete. Having had considerable experience in this class of work in this locality, where soil and climatic conditions are of such nature as to severely test any system of waterproofing that one may be disposed to try, I can testify to the truth of the statement that concrete cannot be made entirely waterproof in itself.

The admixture of waterproofing compounds with the concrete, while certainly beneficial and helpful in final results, cannot be made efficient unless all of the concrete can be poured in one operation; in other words, there will inevitably be leaks at all points where the work has been halted for a sufficient length of time for the concrete to "set," and at other points where the concrete may lack density for various reasons.

The method suggested by Mr. Hall for placing waterproof coating on the water side of walls can be made effective, but, of course, is not applicable to sub-grade structures, such as floors and walls of basements.

Here, in New Orleans, the sub-soil is usually saturated, especially after heavy rains, so that in basement structures it is necessary to consider the hydrostatic pressure as equivalent to a head of water the full depth of the basement, and it is necessary to reinforce concrete floors to withstand the upward water pressure.

The first basement constructed in this city was put in under the supervision of the writer in 1903, and was waterproofed by the application of a cement coating varying from ½ inch to 1½ inches in thickness, applied to the interior face of walls and surface of floors. This coating was waterproofed by the addition of a compound of alum and lye, and proved efficient, no leaks having occurred up to the present time. Before the application of this cement coating, the leakage through the concrete was so great as to require the insertion of pipes through the floor and walls at various points to relieve the water pressure until the cement coating could set. Since this time several larger and deeper basements have been constructed here and waterproofed in the same manner, and no trouble has been experienced where the work has been carefully done. I may say, further, that I have waterproofed brick walls in the same manner and under the same conditions, but a much heavier coating is required than on concrete walls.

There are a number of good waterproofing compounds on the market at the present time which can be used as in the above instances. Most of these compounds are in paste form, and of a soapy nature intended to be first dissolved in water which is afterward used in mixing the sand and cement. An exception to the general run of waterproofing compounds is the use of iron filings, finely pulverized, which, when added to the cement and sand mixture, forms oxide of iron and completely closes all the pores in the cement coating. The writer has had excellent results with this method.

The "membrane" or wool felt and pitch method of waterproofing is effective, but it is more expensive than the cement coating, and it is difficult to locate and repair leaks. SAM STONE, JR.

New Orleans, La.

A Simple Cipher Code

To the Editor of the SCIENTIFIC AMERICAN:

In the very interesting article, "Cipher Codes and Their Uses," continued in your issue of July 3rd, I find no mention of a very simple cipher, combining simplicity in sending and receiving, with a margin of safety much higher than with other codes.

Its operation is as follows: The alphabet can be started with any letter, and with the letters either in aphabetical order or in any position desired, a code number is used, usually of four figures, although any number of figures may be used, but too many makes the code cumbersome and too few easier to decipher. The sender has a spaced rule with a cross followed by the ten digits, thus: + 1 2 3 4 5 6 7 8 9 0. The receiver has an identical rule, reversed thus: 0 9 8 7 6 5 4 3 2 1 +. We will suppose the following arrangement of letters was decided upon with two punctuations and a word space S T U V W X Z—, . A B C D E F G H I J K L M N O P Q R S T U V W X Y Z, the code number to be 3 4 7 9, and the message "The SCIENTIFIC AMERICAN, Woolworth Building, New York."

The sender places the rule with the cross under the letter T, being the first letter of the message, and counts off three letters to the right, as 3 is the first figure of the code number, which brings him under the letter W; next placing the cross under H, counting off four, the next code figure he comes under letter L; continuing the next letter E, code figure 7 brings him under L. Thus the word "The" comes in cipher W L L. To show the ending of a word he places the cross under the dash; code figure gives him nine places to right or letter G. Continuing, the message would read as follows:

W L L G V G P N Q X P O L G E J P I Y R F E U G Z S V U Z S Y, K B I A L P K R Q K E W H—E E R V R I.

The operation of coding is simplicity itself as well as decoding, which is done in the reverse manner. The message for coding would be arranged as follows:

```
THE—  SCIENTIFIC—  AMERICAN—
3479  34793479347  9347934 79
WLLG  VGPNQXPOLGE  JPIYRFEUG
WOOLWORTH—BUILDING—NEW—YORK.
3479347934793479347934793479
ZSVUZSY.KBIALPKRQKEWH—EERVRI
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To decode, the arrangement would be as follows:

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WLLG  VGPNQXPOLGE  JPIYRFEUG
3479  34793479347  9347934 79
THE—  SCIENTIFIC—  AMERICAN—
ZSVUZSY.KBIALPKRQKEWH—EERVRI
3479347934793479347934793479
WOOLWORTH—BUILDING—NEW—YORK.
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A slide rule can be used for sending or receiving, which makes the reading of a message almost as quick as if written in plain writing. H. S. WOODWORTH.

Cedar Crest, Livonia, N. Y.

Development of Iceland's Resources

To the Editor of the SCIENTIFIC AMERICAN:

In the September 6th, 1913, issue of your esteemed paper there is a short notice of a railway in Iceland, which was to run from Reykjavic to Thiorsa, near Hecla. This project is not dead; but, like other good intentions, it may have to bide its time.

No one doubts but that the southern section of Iceland would be better for a railway service if the work could be done without too much outlay, or plunging the people in debt, but there are other public works equally if not more important and sure to give immediate returns, with less outlay. They may have to wait for many years as they are still only on paper.

The utilization of the vast water power which Iceland possesses in its many rivers and cataracts should have been long since begun, for it is the most direct means of overcoming the cold, which is, as everybody knows, the chief obstacle to the progress and prosperity of the inhabitants.

This step, so necessary for the industrial progress and material well-being of the people of this large but woodless and generally barren island, has not yet been taken, because capital has been lacking for great enterprises, and the islanders do not yet possess the technical knowledge which the creation of electrical industries demands.

It is only about 12 years since the first electrical station was erected at Seydisfiord on the east coast of Iceland, and this is only employed for lighting a hamlet of about 700 inhabitants. The capital of Iceland, Reykjavic, is still without electrical light and heat, although water power is abundant in the neighborhood. Akureyri, the chief town of north Iceland, is in the same condition. Indeed, this entire island is yet in an undeveloped state, and the industries are of the most primitive kind, but by good management and perseverance the country can yet yield valuable products and contribute to the general well-being of other nations besides supporting a much greater population than it now boasts.

At present Iceland needs better horses and implements for cultivating the soil, and the foundation of electrical industries, much more than railways to Hecla; and the first care of the people should be to educate industrially trained men and technicians capable of developing the resources of this country—which, though cold and barren compared with the fertile regions of America, or even of Europe, is, nevertheless, neither devoid of resources nor unable to feed a population of several millions if cultivated and utilized as it should be in the near future.

As I write these lines the news reaches me by telephone that the Polar ice still hugs the entire north coast of this island from Cape Horn to Lonquanes. It has lain here since May, and last night the thermometer sank to 1 deg. in some places to 7 deg., so the meadows are but little advanced; but this doesn't destroy our faith in the future. Better times will come. The Polar ice keeps away the thieving men of war—better than fortifications.

Last autumn, and often during the past winter, I observed an arc of auroras running from east to west across the sky from one border of the horizon to the other and situated about 5 or 6 degrees beneath the polar star which has here at Akureyri the altitude of 65 degrees. This arc is, no doubt, a sequent of a circle of auroras encircling the earth directly over the magnetic pole, some 71 deg. north of the Equator. But at what height is this ring of northern lights from the earth? On the 17th of October last I observed, while traveling in Flohadal, north Iceland, a brilliant comet, near the constellation of Orion. The comet was visible from 7 to 12 in the evening for several days. Can any reader tell what comet this may have been?

F. B. ABUGRIMSSON.

Akureyri, Iceland, July 1st, 1915.

The Crystal Detector

To the Editor of the SCIENTIFIC AMERICAN:

It is a well-known fact in physics that a sharp point discharges electricity rapidly while a smooth surface retains it.

The crystal detector consists of a very sharp point resting lightly on a smooth high resistance crystal. The effect of the sharp point lightly touching the high resistance crystal is to make a high resistance which is practically the same as a very small air gap between the point and the crystal, so that a continuous conducting path is not furnished.

When the oscillations are from the point toward the crystal, they are able to pass on, because the point discharges the electricity across the so-called gap or high resistance, but when the oscillations are from the crystal towards the point they cannot pass because the electricity is distributed over comparatively large smooth area and not enough electricity can accumulate in the one spot under the point to leap the so-called gap and thus the rectifying action takes place.

Lynchburg, Va. A. G. THOMAS.

A Good Mixture for Red Fire

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the article on red fire which appeared in SCIENTIFIC AMERICAN of August 21st, the cheapest and best mixture is

Nitrate of Strontium,
Per-Chlorate of Potash,
Sulphur,
Powdered rosin.

If chlorate of potash is used—the combination is liable to ignite from spontaneous combustion—for that reason use per-chlorate of potash. As this has a higher ignition point than chlorate, it will be more difficult to ignite, for that reason a priming is used—containing a small quantity of chlorate—in order to start the ignition.

The more per-chlorate that is used in the mix the faster and "redder" the flame will be; reducing the per-chlorate will make the mix burn longer, but paler.

Guelph, Ontario. GEO. B. JACKSON.

A Question of Increase

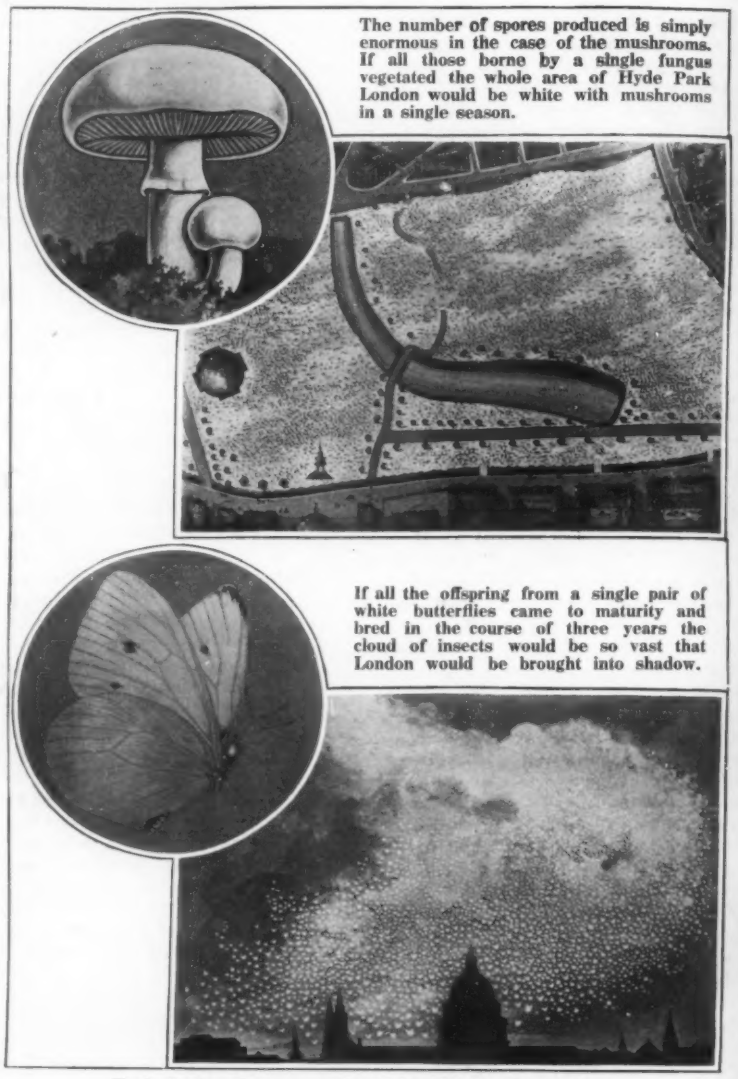
How Small is the Chance That An Individual Will Grow Up

ON this crowded earth the struggle for existence must always be a serious problem. The battle is such a stern affair that the number of those who will go under in the fight is simply prodigious. Where the risks are so great, ever cautious Nature must make special provision in order to maintain the various types which make up the world of living things. All kinds of plans have been brought forward but, one of the most remarkable of these has, to a large extent, been overlooked by students. Although a good many people understand that only a limited number of the baby animals and plants come to maturity, it is doubtful whether any ordinary person has the least idea how small is the chance that an individual will grow up. A consideration of the matter leads one to speculate on the appalling consequences should the adverse conditions, which make the struggle for existence so hard, be removed, and the progeny of any plant or animal all come to maturity. Of course in a matter of this kind it is impossible to make calculations of an exact nature, but certainly if the estimates are at fault, they err on the side of being too conservative.

The Rabbit and Its Offspring

In the matter of increase there are few animals more remarkable than rabbits. These creatures start to breed when they are barely six months old, and they have been known to produce eight or even more litters in the course of the year. The famous Welsh naturalist, Thomas Pennant, kept a record of the offspring produced by one doe, and he found that, in a period of twelve months these numbered no less than fifty-eight. In the Royal Natural History, Dr. Richard Lyddeker has estimated that if a single pair of rabbits were to go on breeding for three years, at the end of this time there would be no less than 13,718,000! It would be difficult to find even standing room for these in the underground railways of London. Of course, in Australia the rabbit has proved to be a great nuisance. Here it would appear that the number of animals and birds which prey upon rabbits is very small; food is abundant, and altogether the conditions are too easy for so prolific a race. For the well-being of the world it would be a good plan if rabbits could be confined to those parts where weasels, birds of prey and other destroying agents are plentiful. The whole trouble in Australia seems to have commenced about sixty years ago, when a farmer loosed a few pairs of British wild rabbits on his land.

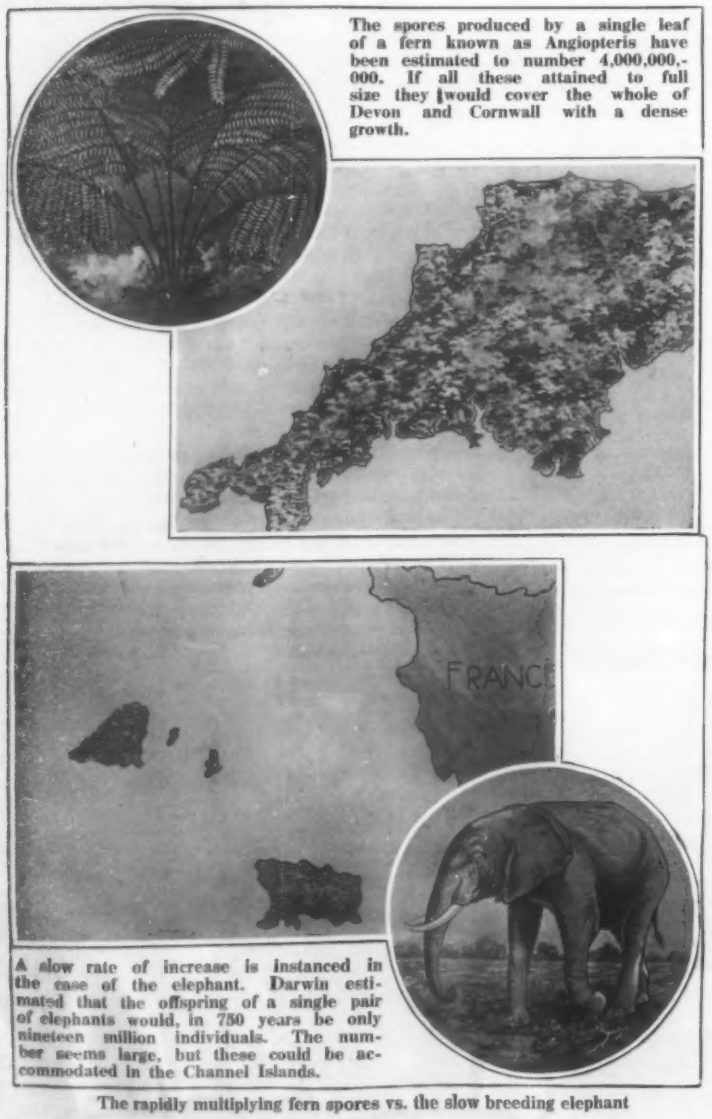
From time immemorial the grower of crops has suffered to a greater or less extent from the depredations of insect pests. These are, of course, serious enough in their way, but when one comes to consider the possibilities of increase in the insect world, it is a wonder that mankind does not suffer more in this direction. Even the worst outbreak of an insect pest is as nothing to that which might happen if some common species were allowed to go on breeding, without any check at all. As an example one may take the case of the White Butterfly. There is little doubt we should be faced with a terrible problem, even if all the progeny of one female grew up and bred without hindrance. It may be said that the ordinary female White Butterfly will perhaps produce forty eggs at a time. For the sake of the argument we may take it that the sexes are equally divided, and that half the resulting butterflies will be females. As these reach maturity they will of course start the egg laying business. The matter is somewhat complicated by the fact that our original female will probably lay quite two batches of eggs in a single summer. As well it is not unlikely that some of her offspring will start laying eggs before the end of the season. The sum is a long one to work through but it comes out somewhat as follows. At the end of three years from the laying of the first batch of eggs by the female White Butterfly with which we started, there would be not less than one thousand million butterflies. Apart from the fact that such a huge army would do an enormous amount of damage in the caterpillar stage, the cloud of fluttering insects in the air would be prodigious—quite sufficient to cast the city of London into deep gloom.



The number of spores produced is simply enormous in the case of the mushrooms. If all those borne by a single fungus vegetated the whole area of Hyde Park London would be white with mushrooms in a single season.

If all the offspring from a single pair of white butterflies came to maturity and bred in the course of three years the cloud of insects would be so vast that London would be brought into shadow.

Unchecked mushroom growth and the offspring of butterflies



The spores produced by a single leaf of a fern known as Angiopteris have been estimated to number 4,000,000,000. If all these attained to full size they would cover the whole of Devon and Cornwall with a dense growth.

A slow rate of increase is instanced in the case of the elephant. Darwin estimated that the offspring of a single pair of elephants would, in 750 years be only nineteen million individuals. The number seems large, but these could be accommodated in the Channel Islands.

The rapidly multiplying fern spores vs. the slow breeding elephant

The Seven Million Eggs of the Codfish

Many years ago, Frank Buckland made an attempt to estimate the number of eggs which would be present in the roe of a fair sized female codfish. After a most careful consideration of the matter he came to the conclusion that these would number not far short of seven millions. A very conservative estimate has shown that if all the offspring from a mother cod grew up, and bred once that it would be difficult to find accommodation for them in the English Channel. In the course of three years the oceans of the world would be blocked if the increase proceeded without any check. Of course the mortality amongst cod's eggs is very heavy, so much so that the chances that any one egg will hatch are very remote. All kinds of marine animals feed upon cod spawn and, it is believed, that even the father cods will eat the egg clusters.

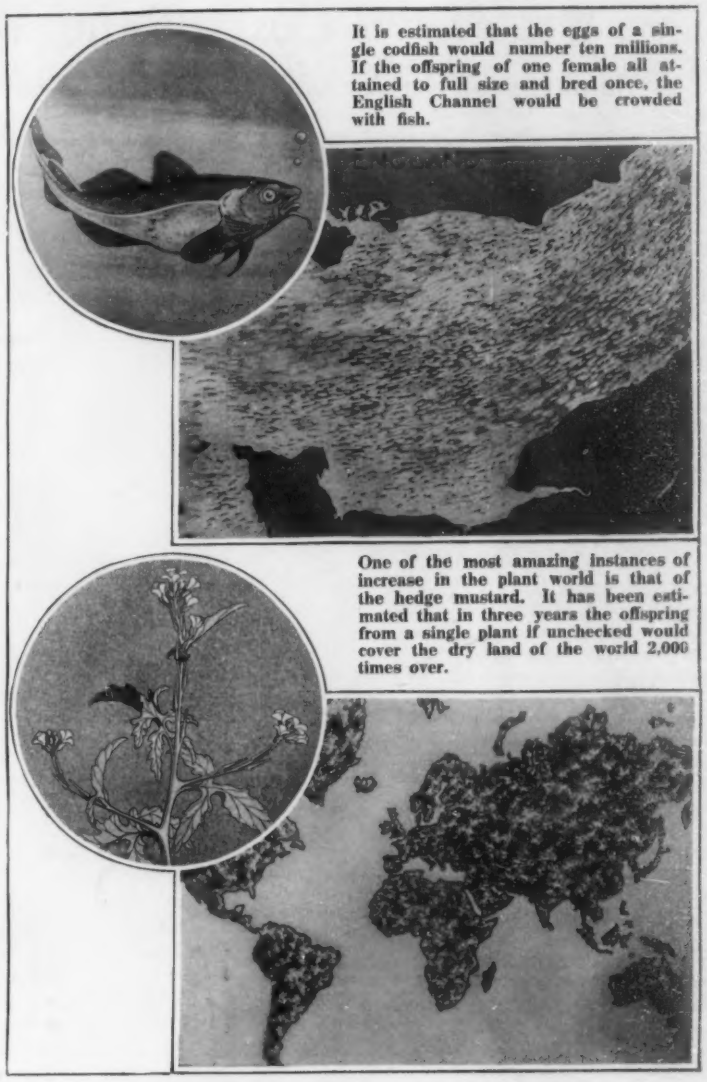
A very innocent looking plant is the Hedge Mustard, a weed which usually contents itself with growing on waste patches, and but rarely troubles the farmer. Yet the famous botanist Kerner has shown that this plant could, if unchecked, increase at a rate which is little short of alarming. The period taken was for three years and, amazing as the result may seem to be, there is every reason for believing that the calculation was worked out with the utmost care. It was considered that the normal increase of the Hedge Mustard, if allowed to go on unchecked over this period, would produce a sufficient number of plants to cover the dry land in the world *2,000 times over*. What is it which, in the ordinary way, keeps this weed, which is of a peculiarly hardy nature, from crowding everything else out? The question is one more easy to ask than to answer, for the Hedge Mustard does not seem to be afflicted with any pests, to a great extent. Perhaps a certain number of the seeds are eaten by small birds, but probably the majority of those which fall to the ground are simply smothered by the press of plants upon this crowded earth.

The Reproductive Possibilities of the Fern

Among the so-called flowerless plants there are to be found some even more singular instances of vegetable increase. As is well known ferns are increased by the production of spores, tiny specks of living matter which are so light that they will float away on the smallest breezes. The spores are produced in little cases on the fronds; these cases burst open when the contents are ripe for dispersal. Now, even in the commonest kinds of ferns, the number of spores borne is simply colossal. Thus it has been estimated that a fair sized plant of the common Male Fern will bear anything between fifty and a hundred millions. But this number is quite eclipsed in the case of some foreign kinds. A certain species, hailing from the Southern Hemisphere known as Angiopteris, has been estimated to produce no less than four thousand million spores *on a single frond*. Now each one of these will, under suitable conditions, give rise to a new fern plant and, as the Angiopteris is a large species with spreading growth, a considerable area of ground would be covered. The fern we must remember is a large one, and it is certain that if all the spores from one frond came to maturity, the great plants which would result could hardly be accommodated on a piece of ground which was two million acres in extent.

The question of increase is an even more bewildering one when we come to the case of the fungi. A very large specimen of the Giant Puffball which was collected in this country, and given to the University of Birmingham, was conceived to have produced spores to the number of 7,000,000,000,000—whatever this gigantic figure may mean. But it is desirable to consider something which is a little more intelligible, and so one may take the case of the common Mushroom with which everyone is familiar. Here it is computed that the number of spores in an average example was not far short of two thousand million. Now each one of these spores is capable of giving rise to those curious white threads which shoot hither and thither underground, and form the vegetative part from which the mushroom rises. In this way a single spore may, in the course of time, be responsible for a very large number of mushrooms. Still even making allowance for the fact that each spore produced but a solitary mushroom of very moderate size we should, from the spores borne by one fungus, be able to cover a gigantic bed more than one thousand acres in area.

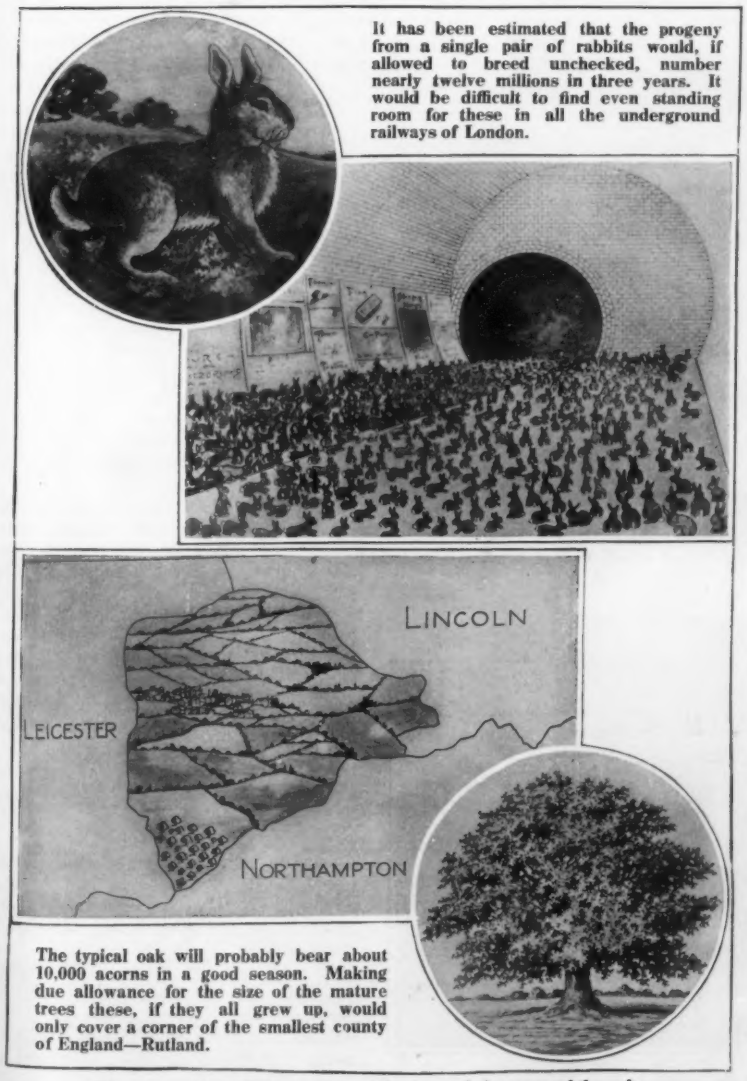
It is not in every living thing that the possibilities of increase are so startling as in those cases which have come under notice. Looking up into the spreading branches of the oak tree it might seem that, in the large number of acorns, there would be sufficient to overwhelm a huge area of land, if they all grew up. When we think of the Angiopteris Fern which, with one of its fronds, might cover two million acres of land, it is difficult to believe that the whole of an oak tree could not achieve something very much greater than this in the way of progeny. Yet this is quite a wrong impression, for all the acorns from one oak, in one season, would not even after they had attained to maturity create more than a fair sized forest. It has been computed that a moderate sized oak, in an average season, will produce about 10,000 acorns. Now even a large oak tree will not spread through its widest part a distance of more than seventy feet. For the sake of convenience we will suppose that each tree would roughly fill a square which measured seventy feet on all sides. In this event, the area which will be necessary for the accommodation of the tree will be about five hundred and forty square yards. A very simple calculation will show that about nine trees of this size could be accommodated on an acre of land. Thus, our ten thousand trees could, with ease, be planted, even when they were of full size, on little more than one thousand acres. This is about a tenth of the actual area of the New Forest. To put the matter in another way, these trees could be comfortably packed away in a corner of our smallest county—Rutland, and their presence would not seriously interfere with the well-being of the people in the district.



It is estimated that the eggs of a single codfish would number ten millions. If the offspring of one female all attained to full size and bred once, the English Channel would be crowded with fish.

One of the most amazing instances of increase in the plant world is that of the hedge mustard. It has been estimated that in three years the offspring from a single plant if unchecked would cover the dry land of the world 2,000 times over.

Millions of codfish eggs and the enormous spread of mustard seed



It has been estimated that the progeny from a single pair of rabbits would, if allowed to breed unchecked, number nearly twelve millions in three years. It would be difficult to find even standing room for these in all the underground railways of London.

The typical oak will probably bear about 10,000 acorns in a good season. Making due allowance for the size of the mature trees these, if they all grew up, would only cover a corner of the smallest county of England—Rutland.

Three years' breeding of rabbits and one year's increase of the oak

Darwin and the Elephant

In the case of the Elephant we shall find an even more remarkable case of slow increase. Darwin, in the "Origin of Species" gives the result of a series of calculations which he made in order to discover the probable result, if one pair of elephants were allowed to go on breeding without any check and all the offspring did the same. We are informed that, as a rule, elephants do not begin to breed until they are thirty years of age. Now during its lifetime the female elephant will be responsible for six young. Basing his calculations on these facts, Darwin worked out the following estimate. Making an allowance that all the elephants would survive until they were one hundred years of age, it was found that, in a period from 740 to 750 years, there would be nearly nineteen million elephants alive descended from the first pair. The thought of nineteen million elephants is almost staggering, but we must remember that it would take over *seven and one-half centuries* to arrive at this total. Though the number seems to be large, yet the great herd could be accommodated on a much smaller piece of ground than might be expected. Thus, even a very large elephant could stand on a plot of land which was about ten feet by five. Now if we allow double this amount of space, we should be able to find room for all the elephants in the Channel Islands. It is singular to compare this slow rate of increase with that of the rabbit, which has already been under consideration. In the case of the smaller animal a period of only three years was allowed, and yet an enormous total was reached. What would happen in the event of the offspring of a pair of rabbits, breeding without any check for seven hundred and fifty years, it is difficult to estimate. Without a doubt there would be a sufficient number of animals to crowd this earth many thousands of times over.

The question of the means which are employed by Nature to check undue increase in any one species, is a matter which is full of interest. In most cases it is not an easy business to account for the enormous mortality amongst the offspring of a certain animal or plant. Probably the greatest factor of all in keeping down the number of animals is the problem of finding enough to eat. The individual, living on the borderland of starvation itself, is probably regarded as a suitable meal by a host of hungry enemies. In the case of plants the balance is largely maintained owing to the tremendous difficulty of securing a situation in which to grow at all. Every square foot of this earth, which can support any form of vegetable life, is crowded to its utmost capacity; when any vacancies occur there are thousands of competitors for each opening. Small wonder that so many go down in the fight. It is singular to reflect in what a reckless way Nature sacrifices life in order to make certain the continuity of the race.

Cost of the War in Airships

Summary of the Airship Losses of the Central Empires Since the Beginning of the War

By Ladislas d'Orcy

ALTHOUGH it is somewhat difficult to give in the face of so many contradictory reports a tabulated statement of the airship losses Germany and her minor consort, Austria-Hungary, have so far sustained during the war, the following review will be found fairly accurate, having been compiled mostly from official British, French, German and Russian reports. Where such reports were not available, reliable neutral information and private intelligence were used.

Regarding the exactitude of the figures given herewith, it should be noted that in a statement published by the *Constanzer Nachrichten* late in March 1915, Count Zeppelin admitted that during the first eight months of the war nine airships of his system had been lost through various causes; these figures will be found to be in strict accordance with the ones printed herewith.

August 1914

The first month of the war caused extremely heavy losses in the ranks of the German airship fleet, which is accounted for by the extensive employment of Zeppelins and other airships in day-time, when they proved a rather easy target for the gunners and airmen of the Allies.

In fact, seven German airships were attacked during this month by Allied airmen or hit by anti-aircraft shells, but only two of them were actually destroyed.

On August 6th the Zeppelin *Z-4* was damaged by Belgian gunners during the bombardment of Liége. Two days later a French airman, Corporal Perrin, encountered a Zeppelin in mid-air over Chateau-Salins and scored a hit with a bomb, forcing the airship to land. On August 18th two French airmen, Lieut. Cesari and Corp. Prudhommeau, attacked the German airship shed at Metz and dropped several bombs, one of which disabled a Zeppelin that was housed there. On August 20th French scouting aeroplanes belonging to the so-called Army of Belgium reported to have seen two Zeppelins in a badly damaged condition near Luxembourg.

August 22d recorded the actual destruction of the first Zeppelin, the *Z-8*, which was brought down on the road from Celles to Badonviller by the fire of a concealed French field battery, the whole crew being killed.

One week later, on August 29th, the Zeppelin *Z-5* was fired upon near Mlava by a Russian horse battery and forced to land, her steering gear having been destroyed by a shell. The crew were made prisoners by a Cossack patrol, who took the Zeppelin's battle flag from the wreck and then set her afire.

September 1914

On September 6th a German military airship, while at anchor near Seradj, was captured with her crew of thirty officers and men by a Russian cavalry detachment delivering a surprise attack. The number of the crew led to the belief that this airship was a Zeppelin of the naval type, probably the one which at the beginning of the war was stationed at Koenigsberg.

On September 10th two Austrian airships met the same fate at the hands of a Russian cavalry patrol near Peroden. One of them was a very large airship, probably the Schuette-Lanz No. 2, as her crew numbered thirty-nine officers and men and the Russian official report did not call her a Zeppelin. The other aircraft was a pressure type (non-rigid) airship of much smaller dimensions, possibly the old Austrian Parseval *M-2*.

On September 28th the Russian Minister of War announced that a German airship, while engaged in dropping bombs upon Warsaw, was fired at by the forts and put to flight in the direction of Novo-Georgievsk. The fire of the Russians soon took effect, for the airship was finally forced to land near the fort of Modlin, where she was captured with her crew. This airship was apparently a Parseval.

October 1914

Only one German airship—a military Zeppelin—was considerably damaged during this month.

On October 9th a British squadron of three aeroplanes under Flight Commander Spencer Grey attacked the German airship shed at Duesseldorf. The bombs launched by the Britons from a height of 500 feet hit the shed squarely in the middle and set fire to the military Zeppelin that was housed in it. This was the second expedition by British airmen against the sheds at Duesseldorf, the first one, undertaken on September 22d, having failed in its purpose.

The "Deutschland," one of Germany's antebellum Zeppelins

November 1914

On November 15th a storm-tossed airship, probably a Parseval or a Gross-Basenach, passed over Maestricht, Holland, flying low in an almost vertical position and making erratic, jerky movements. The crew was seen clinging to lines, undoubtedly for fear of being thrown overboard. The airship seemed to be badly damaged in the rear, but by desperate efforts managed to reach the German frontier, where she fell to the ground and was totally wrecked.

On November 21st a British squadron of three aeroplanes, under Squadron Commander E. F. Briggs, R.N.A.S., attacked the Zeppelin Works at Friedrichshafen, on Lake Constance. The three airmen, unperturbed by a heavy fire from anti-aircraft guns, dived steeply within 300 feet of the sheds upon which they launched eleven aircraft bombs. Soon afterwards flames of considerable magnitude were seen issuing from one of the sheds. Supplementary information obtained from reliable sources stated that one airship, the *LZ-31*, which was to have passed her acceptance tests the same afternoon, had been totally destroyed by this attack and that the hydrogen generating plant had also been demolished.

Location of German dirigible sheds

December 1914

No Zeppelin was lost during this month, although one airship of this system was damaged on December 4th in an aerial battle fought in Northern France with a British squadron of three aeroplanes. Two Parseval airships were, however, destroyed during this month by the agency of British airmen.

On December 24th Squadron Commander Richard B. Davies, R.N.A.S., flew over Brussels and dropped twelve bombs on an airship shed which was reported to house a Parseval airship. Eight of these bombs, six of which are believed to have hit, were discharged at the first attack and the remaining four on the return flight. Heavy clouds of smoke were seen issuing from the shed and this permits the assumption that the Parseval contained in it was actually set on fire, as the airship was the only combustible matter the shed contained.

On the following day, December 25th, a British squadron of seven aeroplanes under Flight Commander Douglas A. Oliver attacked the German naval and aerial base at Cuxhaven. According to the London *Times*, a Parseval airship was blown up in her shed by the bombs, while a large Zeppelin shed was damaged with its contents.

January 1915

The first month of the new year cost the German Air Service two airships—a new naval Zeppelin, which was accidentally lost in the North Sea, and a Parseval, which was captured near Libau by the Russians.

On January 23d a Zeppelin which seems to have been the *L-7* was lost in the North Sea with her crew. The first news of this disaster was brought to Nordwyk, Holland, by the skipper of a Dutch fishing smack, who stated that he witnessed an airship of unknown nationality founder off the Dutch coast; the description he gave of this aircraft proved that she was a Zeppelin. His report was confirmed a week later by private intelligence from Friedrichshafen, to the effect that a Zeppelin of the naval or *L* class, which had been delivered to the German Navy only a short time before, was overdue from a reconnaissance flight over the North Sea and was considered as lost.

On January 26th the German airship *P-5*, a Parseval, appeared over the Russian port of Libau, coming from the sea and dropped several bombs which damaged some property and injured several civilians. But almost instantly an armored motor car of the Frontier Guards started in pursuit and having gotten within range, opened fire. This proved most effectual, for the airship soon fell into the sea about a mile from the shore; launches held in readiness for this eventuality rushed to the spot and captured the airship with her crew of two officers and five men.

February 1915

On February 17th two German naval airships, the *L-3* (Zeppelin) and the *L-4* (Schuette-Lanz) were wrecked upon their return from a reconnaissance flight over the North Sea on the Danish Coast.

The *L-3* had left Hamburg at 4 A.M. the same day and had been cruising off the northwest coast of Denmark. Her engines failed one after the other and at about 6 P.M. the airship landed with a

(*Concluded on page* 307)

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Wreck of Zeppelin L-3 on the beach of Fanoe Island

Collapse of the Subway Work on Seventh Avenue

Possible Cause of the Accident and the Lessons It Teaches

A BROADSIDE fired from one of our dreadnoughts will send a volley of projectiles racing on parallel courses with velocities so nearly identical that when they land six or eight miles away, only a few score yards will separate the leader from the laggard. The science of explosives has reached such a high degree of accuracy that the exact amount of energy stored in a given quantity of the material can be foretold with absolute precision. This is just as true of dynamite, when fresh, as of smokeless powder, and yet blasting is always a hazardous undertaking, not because of any question of the power of the explosive, but because it is impossible to foretell what resistance the rock will offer to the blast, and how much dynamite will be required to shatter it.

Seldom does one encounter difficulties greater than those offered by the rock of Manhattan. Some of it is very hard, much of it lies in strata that are inclined at a dangerous angle, and a great deal of it is soft and disintegrated. A face of very hard rock may screen a pocket of material so soft that it can be broken up in the hand. Naturally where the drills bore with difficulty through a tough bit of rock, a correspondingly heavy charge is inserted, but if that rock is a mere shell overlying soft rock, the resultant blast will blow out an excessive amount of material.

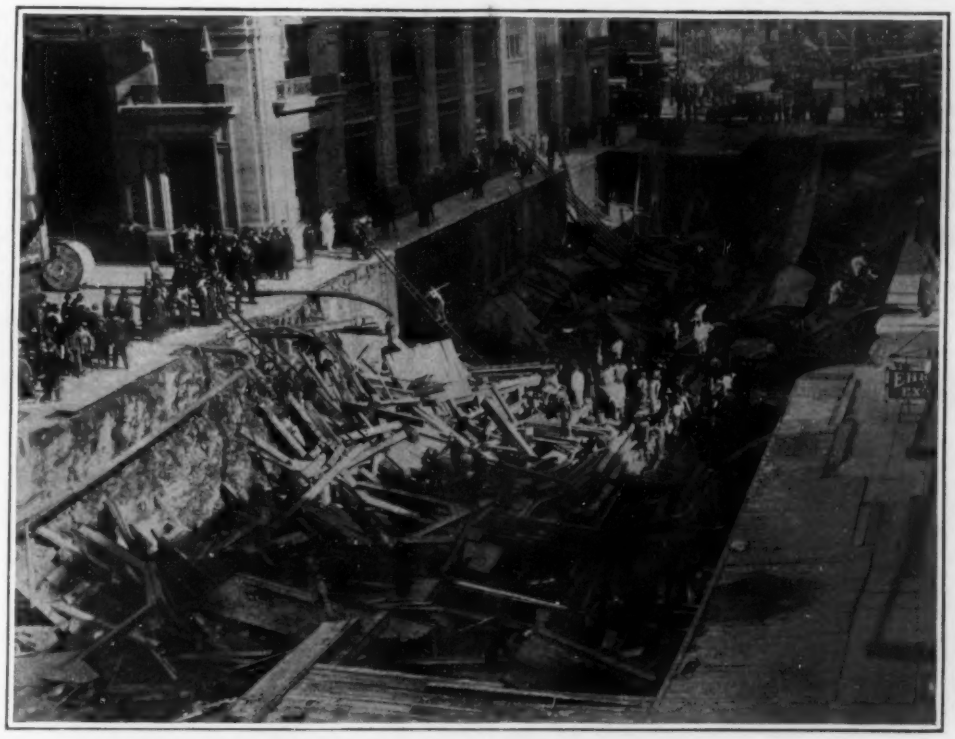
Possibly it was some such condition that occasioned the collapse last week, of about 300 feet of the street surface of New York at Seventh Ave., from 25th St. to a little below 24th St. The subway here is being constructed by the "cut and cover" method. In other words, the street paving is replaced with a timber decking, under which the excavation proceeds. The decking is supported by timber bents which, as in all such work, are spaced 10 feet apart on centres. At this particular point extra heavy timbers were used, varying from 12 to 14 inches square in cross section. In fact, this section was referred to with mild derision by other contractors as a "lumber pile," because of the excess of precaution taken, as shown by the use of extra heavy timbers.

The method of procedure at the heading, which is common in almost all of the subway work, was to carry the street load on steel beams which were supported at one end on a tower in the excavation, while the farther end rested well over the surface of the rock. As the rock was shot away columns were introduced between the rock face and the tower, to provide additional supports for the columns. Before the rock support was entirely blasted away, the beams were moved forward and supported at their rear ends on a new tower. Such was the condition at 25th St. The columns on the east side of the excavation were resting on the rock at their forward ends, and there were two supports between the rock and the tower. On the west side there were three supports in place. A blast was fired in the rock face on the east side. The quantity of dynamite was not excessive as judged by the nature of the rock previously encountered in that portion of the work. What actually occurred cannot be determined at the present writing. Possibly a large piece of rock was thrown out against the tower, demolishing it and dropping the beams into the excavation. At any rate, immediately following the blast, the entire street collapsed, and a trolley car that was within a block of the point, coasted down into the excavation and was demolished. The excavation here is about 25 feet deep.

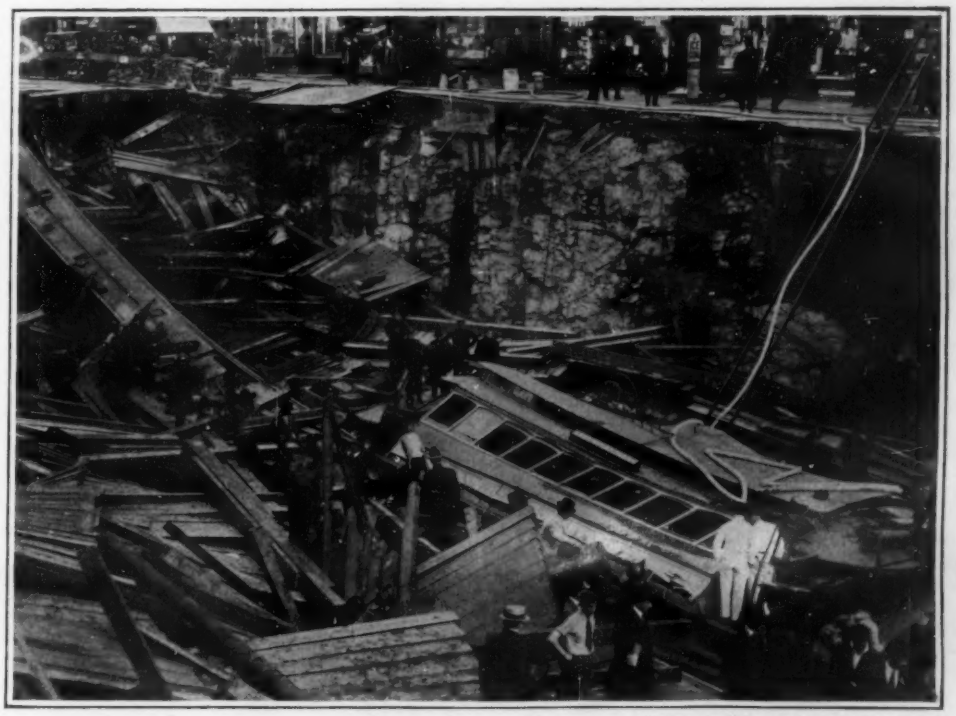
It seems incredible that the destruction of a single tower would cause such extensive havoc. Probably as each bent collapsed, it put a strain on the next one, and the process of destruction went on until it reached the steel and concrete work, just below 24th St. It is rather puzzling, however, to explain the positions of the various members. The shoring was arranged in two decks, and apparently the upper deck was thrown northward, while the lower deck was thrown southward. Naturally, with the structure giving away at the north end, one would expect to find a decided surging toward the north, and yet at the south end, the steel work that is standing has been pushed southward. This may have been due to a reaction, after an initial northward pull.

At present writing we do not know enough about the cause of the disaster to determine how such an accident may be avoided in the future, and yet it is vitally important that this point should be settled at the earliest possible moment, because miles and miles of New York streets are supported in just this way at the present moment. The system of shoring has been studied by hundreds of engineers, and has been examined by experts from all over this country and abroad, with no criticism of its competency to withstand the stresses that are liable to be imposed upon it. Apparently while every provision is made for vertical thrusts of the live street load overhead, no adequate provision is made for longitudinal thrusts, such as occurred in this accident, and as each bent was connected to the next one, they were successively pulled over.

In this connection, one cannot help but wish that the use of dynamite could be avoided in the heart of a large city. A system of shattering rock by means of hydraulic cartridges has been employed to a limited extent in places where it is impossible to use explosives for fear of igniting gases. It is not impossible that a system such as this might be employed in New York city. The hydraulic cartridge consists of a metal cylinder with a number of rams that project laterally from it. The cylinder is introduced into the hole drilled in the rock and then by means of a pump and a piston operated by a powerful hand screw, the rams are forced out of the cylinder, fracturing the rock, but as soon as the rock is cracked, the pressure is relieved, and the action stops, hence the material is not broken up into small pieces, which, of course, is a disadvantage. Another substitute for dynamite is the tunnelling machine. Several machines of this type have been developed, and the plans are on foot for installing a tunnelling machine in the new subway work under Lexington Ave. It will be interesting to watch the operation of this machine, and see whether it offers an efficient way out of the hazards to which the city is exposed whenever any work is done in its treacherous underlying rock.



Wreckage caused by the collapse of the street in the Seventh Avenue subway work



Photos copyright Underwood & Underwood

Wreck of the trolley car that fell into the excavation

Serbia a Factor in the War

In spite of the fact that Serbia within the past few years has been engaged in three terrific wars, first against Turkey, then against Bulgaria, and finally against Austria, in the last-named of which, after being heavily invaded, she threw the enemy back with terrible losses entirely out of her country and across the Danube, this wonderful little country, in spite of ravages of cholera, in which her losses probably approximated those in her struggle with the Austrian army, now reinforced by the British and French, claims that she is fully ready for any Teutonic attack. The Serbians state that it would require an army of at least 450,000 men to make a successful drive through her mountains.

Recoil Mechanism of Modern Guns

High Rate of Fire of Present-day Field Pieces due to Elimination of Resighting and Readjustment

THE greatest improvement that has been effected in field guns within the past one or two decades is the introduction of a recoil mounting or mechanism for the gun. No longer is the gun proper mounted rigidly on its carriage as was the practice at the time of the Spanish-American war. Instead, the gun is provided with a mechanism that permits it to move freely during the recoil following the discharge, without altering the position of the carriage. Furthermore, the mechanism returns the gun to its normal position, ready for the next shot and without involving the necessity of resighting or readjustment if the target remains the same.

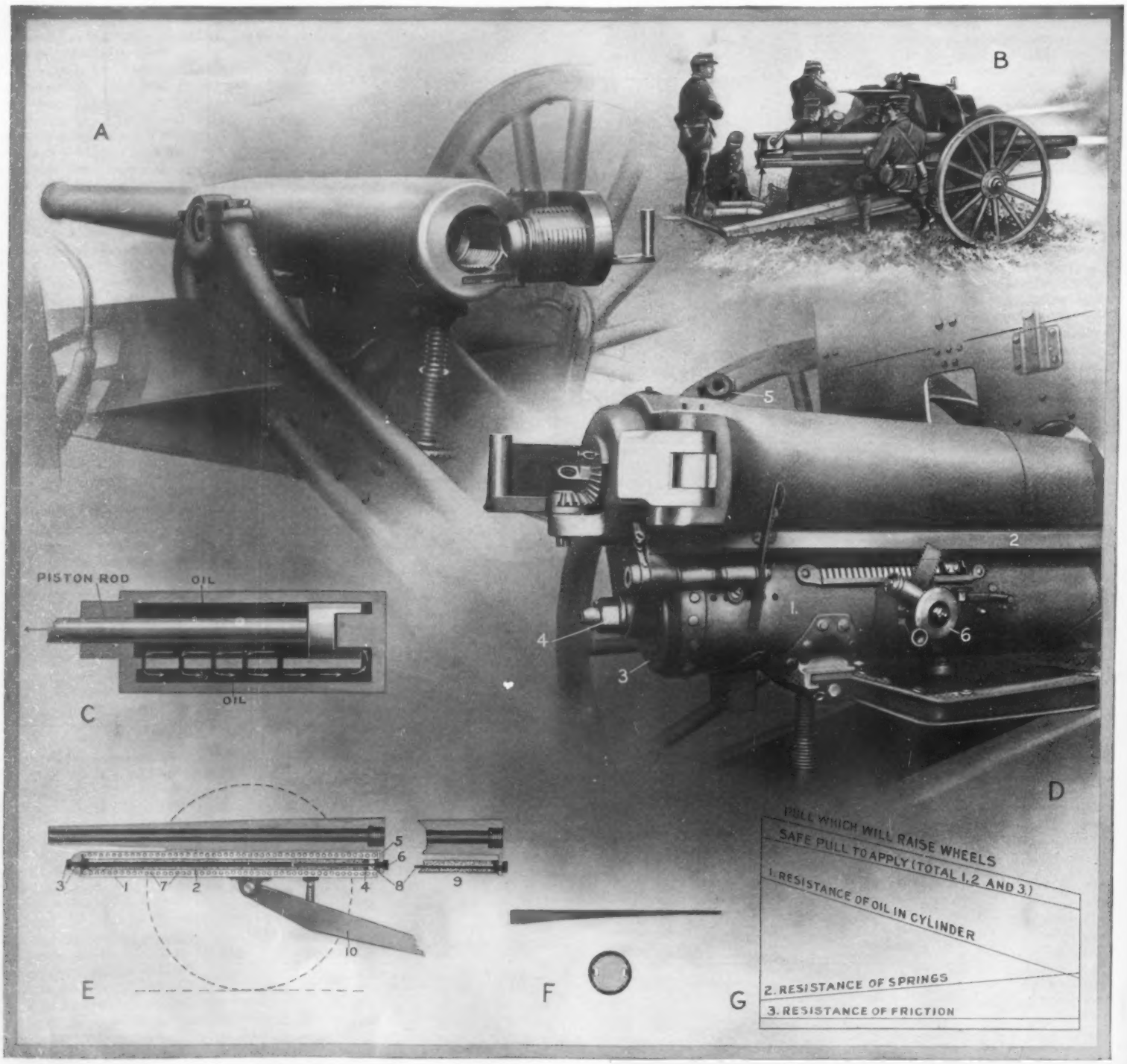
The 3.2-inch field gun carriage illustrated at *A* is typical of those belonging to the past generation, and was the carriage used by the United States Army in the Spanish War. The gun is a rifled breech loader, and round for round the accuracy compares favorably with any now in use. It employs smokeless powder and the range is not greatly inferior to that of the modern light field gun now in use in the United States Army. However, this 3.2-inch gun is no longer considered suitable for use with a field army unless possibly in extreme emergency. It has been relegated for use in the field works which would be erected in time of war for the defense of the land side of seacoast fortifications.

The 3-inch successor to the gun shown at *A* is depicted at *B*. Improvements in the ammunition, breech mechanism and sighting arrangements have been made, together with the addition of a shield, but the greatest difference lies in the fact that the old gun is connected directly to its carriage by a pair of ordinary trunnions of the type used for hundreds of years, while the new gun is connected to its carriage by an arrangement which permits it to move to the rear about 4 feet without altering in the slightest degree the position of the carriage.

In the first gun the total powder pressure on the breech block at the instant of firing is approximately 250,000 pounds and, since the gun is rigidly connected to the carriage, this great pressure moves both gun and gun carriage backward several feet along the ground. The gun squad must be clear of the gun to avoid injury, and before the next shot can be fired it is necessary to push the carriage to the front and carefully resight the gun. Four aimed shots per minute is about the best average of a skilled gun crew handling a field piece of this kind.

In the case of the new gun the same powder pressure is encountered, but the gun is mounted on ways or guides on the carriage which permit it to move to the rear without transmitting the powder pressure to the carriage. Hence there is no tendency for the latter to move during the recoil. The pressure lasts but a small fraction of a second and at the end of the period the carriage is standing still while the gun moves to the rear with considerable velocity.

The recoil mechanism of the modern field piece is simple in principle. To the gun is attached a cylinder which moves with it, while inside the cylinder is a piston which is attached to the carriage by a piston rod. The cylinder is filled with oil, and a variable



Rigidly mounted gun in general use two decades ago, and the present-day recoil mounted field piece, together with diagrams depicting the functioning of the recoil mechanism.

A.—A 3.2-inch gun carriage of the type employed during the Spanish-American war. Note the rigid connection between the gun and its carriage, resulting in the carriage being moved by each discharge of the gun. *B*.—Modern long recoil gun the instant after firing. The exposed recoil cylinder is indicated by the arrow. In about a second's time the counter-recoil springs will have pushed the gun forward to its firing position. *C*.—Diagrammatic view of the action of the simplest form of recoil mechanism. *D*.—Recoil mechanism of a modern field gun. The parts are indicated as follows: 1. Sheet steel cradle containing recoil cylinder and springs. 2. Clips on the bottom of the gun that slide on ways or guides on the cradle. 3. Rear end of recoil cylinder. 4. Nut for attaching recoil cylinder to the lug on the gun. 5. Sight for giving direction. 6. Quadrant for giving elevation. It will be noticed that the gun is not rigidly attached to the carriage but is so mounted as to slide back and forth thereon. *E*.—Section through the field gun and carriage illustrated at *D*. The parts are indicated as follows: 1. Sheet metal cradle. 2. Cylinder filled with oil, which is indicated by dots. 3. Piston rod and nut attaching it to the cradle. 4. Piston. 5. Lug on gun to which cylinder is attached. 6. Nut holding cylinder to lug. 7. Counter-recoil springs for returning gun to firing position. 8. Counter-recoil buffer for preventing too violent return to firing position. 9. Gun and cylinder in recoiled position. 10. Trail. *F*.—Cross section through the piston and cylinder, and an outline of one of the ribs on the interior of the cylinder. Due to their peculiar form, the ribs gradually close the slots in the piston during recoil. *G*.—Diagrammatic representation of the relationship of the various factors in designing recoil mechanism.

clearance is provided around the piston. As the gun recoils the oil must pass through this clearance at a rather high velocity, resulting in considerable pressure being developed in the cylinder which gradually brings the gun to rest. This pull acts through the piston rod in the opposite direction on the carriage, but it is so regulated that the movement is steady and not great enough to lift the wheels from the ground or push the "spade" at the end of the trail through the earth. It is therefore unnecessary to resight the gun for the next shot or at the most to make but slight adjustments by elevating the gun or moving it from side to side with the mechanisms provided on the carriage. The firing may proceed as rapidly as the gun can be loaded, which is about twenty times a minute as compared to the three or four shots per minute of the older field piece.

An obsolete type of recoil cylinder is shown at *C*, and it effectively serves to illustrate the basic principle of controlling recoil by an oil cylinder. As the piston rod moves in the direction of the arrow, the oil is forced to the other side of the piston through the small ports and bypass as indicated, the resulting pressure offering resistance to the movement of the piston. Since the velocity of the latter is checked, the resistance of the oil would decrease and the pressure would not be uniform if the area of the ports remained constant. To overcome this objection a number of ports are provided, which are closed successively to the escape of the oil as the piston passes by them, until finally no passage remains.

In the earlier hydraulic recoil systems the port area was constant, being merely a hole drilled through the piston. This construction proved objectionable, for when the piston first came in contact with the oil it was moving with comparatively high velocity and with the oil pressure likewise great, resulting in a heavy cylinder, difficulties with packing, and a piston rod pull so powerful that with a field gun the wheels would rise from the ground, necessitating the resighting of the gun for the next shot and defeating the scheme of the entire recoil mechanism.

In addition to the arrangements for checking the recoil, the gun must be returned to the firing position on the carriage; the latter operation being accomplished by springs or compressed air which has been compressed during recoil. The springs help to check the recoil but their resistance is small compared to that of the oil. During the return to the firing position or counter-recoil the gun acquires considerable energy which must be gradually checked, or the shock of stopping may derange the aim. This is effected by introducing a small oil cylinder formed by drilling a hole in the rear end of the piston rod and a corresponding plunger fastened to the inside of the rear cylinder head.

The whole arrangement is shown at *E*, which is typical of the spring return carriage used by most countries. At *F* is depicted the cross section of the piston and the cylinder which has two or more longitudinal ribs on its interior, together with an exaggerated section of one of the ribs along which the slots in the piston move in recoil and which gradually close the ports until they are fully closed at the end of recoil.

A clear understanding of the relationship between the various parts referred to in the foregoing will be obtained by following in a very general way the steps in connection with the design of the gun carriage shown at *D*. Such a gun is intended to keep pace with cavalry on the march and to move rapidly into position over almost any kind of ground. More guns of this type are employed than of any other single type, and, as far as is known, no country has as yet contemplated using motor transport extensively with guns of this kind.

For that reason the total weight of a gun of this kind is limited to the weight that can be pulled by six horses, which experience has shown is the largest team that can be used to advantage, while six hundred and fifty pounds per horse is the normal load under the conditions. Of the total load of about 4,000 pounds, approximately 1,500 pounds is allotted to the limber—the two-wheeled vehicle to which the trail of the gun carriage is attached for transportation. The limber carries about thirty rounds of ammunition for emergency use.

A well-designed gun of this type throwing a fifteen-pound projectile weighs about 800 pounds. The greater the weight of the recoiling parts the less energy there will be on these parts, hence the cylinder and its filling of oil recoils with the gun while the lighter piston rod is attached to the carriage. The front end of the spring column recoils with the velocity of the gun, the rear end remaining stationary. It is therefore customary to add one-half the weight of the springs to that of the recoiling parts. Adding these weights to that of the gun the total recoiling weight is in the neighborhood of 1,000 pounds.

The velocity of free recoil is determined by the formula,

$$V = \frac{Pv + 3000p}{W}$$

in which:

V = velocity of recoil in feet per second.
P = weight of projectile in pounds.
v = velocity of projectile in feet per second.
p = weight of powder in pounds.
W = weight of recoiling parts in pounds.

The velocity of free recoil must be checked by a pull which will not lift the wheels from the ground, which pull must decrease as the recoil becomes longer since the weight moved to the rear makes the wheels easier to lift. The permissible pull may be represented as a straight line, as shown in the chart at *G*, while the total length of recoil must be such that the area under this line will represent the number of foot pounds of energy to be taken care of.

A certain amount of energy is taken up by friction and likewise by the compression of the counter-recoil springs, but the remaining and greater portion must be taken up by the resistance of the oil in the cylinder. The area of the orifice at any particular point of the recoil is determined by the formula,

$$a^2 = \frac{wA^2V^2}{64.4P}$$

in which:

a = area of orifice in square feet.
w = weight of cubic foot of oil.
A = effective area of piston.
P = total pressure desired on the piston.
V = velocity of recoil at the time in feet per second.

Contraction of the liquid vein flowing through the orifices and the fact that the actual maximum recoil is slightly less than that given by the formula, due to the retarding forces acting and other minor considerations, make the actual problem somewhat more involved than outlined herein.

In the case of howitzers which ordinarily fire at high angles of elevation and of field guns arranged to attack air craft, it is necessary to automatically shorten the recoil as the elevation increases to prevent the breech of the gun from striking the ground. Several sets of orifices, each giving a different length of recoil, are computed as indicated, and the mechanical construction of the recoil system is so made that as the gun is elevated the set best suited to the particular elevation is brought into play.

Scientific Solution of the World's Cotton Problem

By Lehman Johnson
COTTON AND COTTON SEED SPECIALIST

THE cotton states have a special problem of their own, a pressing one—the marketing of this year's relatively small crop at anything like a fair price, under the abnormal and depressing war conditions.

But there is a larger problem, a world problem that has long been with us and will long remain until rightly solved.

The Problem Stated

The world problem in regard to cotton is: How can we bring it about that the cotton states, which have a virtual monopoly of cotton production, shall produce what cotton the world needs without taking advantage of their monopoly in exacting too high a price, nor yet suffer such terrible losses as the prices in various seasons, of from five to seventeen cents a pound, indicate? In other words: How can we procure a more stable production and more stable prices for cotton so that the world's commerce and manufactures shall not be so often disarranged and made the football of speculation? The consumer, the laborer who cannot afford to buy calico dresses for his family made out of seventeen-cent cotton, the manufacturer who cannot afford to manufacture and store goods made out of such high priced cotton when he may the next year be urged to buy his raw product at five or six cents a pound—all are interested in the cotton problem. In short, every consumer, every producer of cotton, every cotton mill and every cotton oil mill throughout the world is interested in the solution of this problem. So, too, although to a less degree, are bankers and honest merchants interested. Those least interested are the speculators.

Elements of the Problem

A brief review of present facts and conditions will be helpful in considering the possible solutions:

1.—The cotton growers take on the average two and a half acres of more or less worn out land to raise one bale of cotton when one acre of land properly cared for and worked would raise the bale with less expense.

2.—Even under present conditions the average production of cotton seed per acre is nearly fourteen bushels, which is very close to the average of wheat per acre. On bale-to-the-acre lands of this so-called by-product of cotton there are sixty-six bushels of cotton seed necessarily raised.

3.—Cotton is the most imperishable of all agricultural crops of any size, the most generally useful and, for most purposes, so cheap that no other fiber, which can be or is grown in quantity, can take its place.

4.—The seed of the cotton plant, so long as it is protected by the fibrous covering which Nature gives it, is the most imperishable of seeds, given similar weather conditions. But when stripped of this covering, as is done in ginning, it is the most perishable of seeds and the most difficult to preserve in quantity.

5.—Bushel for bushel, though thirty pounds constitute a bushel of cotton seed and sixty a bushel of wheat, the cotton seed has a latent and possible analytical value as food for man and beast fully equal to that of wheat. It comprises the largest single source of protein and fat that we have to-day.

6.—Needless to state, so crude are the methods of handling, manufacturing and marketing the seed and its products that the oil mills do not realize nor are they able to pass on to the farmer but a fraction of the real value of the seeds.

7.—It is the general custom of cotton growers to pick the cotton in three or four months—which is proper—and to gin and mill the seed in the same short space of time, running the gins and oil mills overtime, night and day, for the purpose and allowing them to remain idle the rest of the year. This is obviously bad economics, also necessitating hurried and improper manufacture and marketing both of cotton and cotton seed products.

8.—There are neither cotton, seed cotton nor cotton seed barns on the cotton farms such as we see on almost every grain and hay farm in the north and west, built by the farmers to store products worth only one-tenth as much as cotton products.

9.—Bankers, merchants and landlords are too free in extending credits to cotton farmers before the seeds are planted, too parsimonious with their credits on the cotton itself after it has been grown, too blind to include in their credits the grain and forage crops and live stock.

10.—Too many cotton farmers are slaves to habit or custom, to bankers, landlords or merchants, unwilling sometimes but more often unable to devote any acreage of the land they control to anything but cotton, uninterested in maintaining the fertility of the soil, wasteful of stable manure, unfamiliar with the value of nitrogen producing crops, and extravagant in the use of stimulating commercial fertilizers.

11.—Of necessity these all-cotton slaves must part with the title to their cotton, immediately on picking and ginning, to stronger hands—the landlords, the merchants, the speculative buyers and the spinners or their agents. They themselves cannot borrow on their cotton since it is already pledged and since they need even the small margin between borrowing and commercial value.

12.—If the banks in the cotton states had all the money in the world and insisted, as they have a right to and must, on margins on cotton loans, they could not (when there is prospect that the approaching crop will fill the world's needs) prevent the sacrifice by this large class of original growers of three million or more bales of cotton to somebody at the very start of the season. The only protection these all-cotton farmers collectively have is to grow less than the world needs and set the buyers early to bidding against each other for their cotton to the great disadvantage of spinner and ultimate consumer. This they sometimes do, hence seventeen-cent cotton. But more often they miscalculate the consumption of the coming season, over plant, and the three million or so annual surplus results in five-cent cotton.

13.—In seasons of surplus, the excess cotton is entirely out of the hands of the original grower, hidden away in spinners' or public warehouses which the grower never sees, and is accordingly no guide or check to him in planting the following crop.

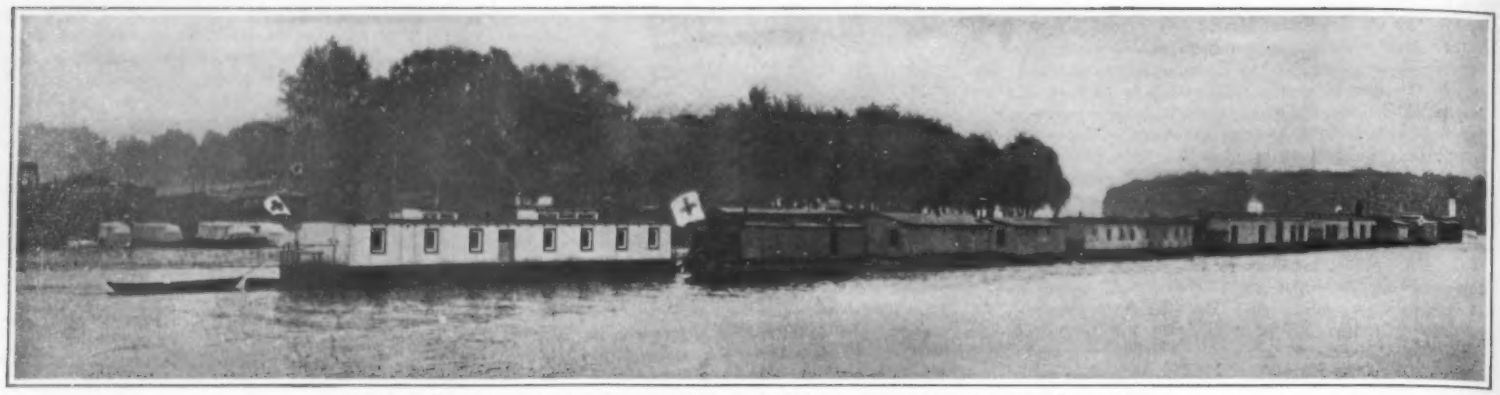
14.—The natural and final result is that the production of American cotton, instead of being regulated by the modern hair spring of wise marketing and distribution of product, is governed by the clumsy swing of the pendulum of price between five and seventeen cents a pound.

From this array of facts it is difficult to escape two conclusions: First, that the bankers, merchants and landlords of the cotton states are "inefficiency experts" of a high order who have been building the prosperity of the cotton states literally upon a foundation of sand and have taught—even compelled in many cases—the more ignorant class, the farmers, to do likewise. Secondly, the outside world interest in cotton manufacture and consumption cannot afford to wait till the cotton states work out this gigantic problem, but must lend a hand in its solution.

Essentials Toward Solution

The first essential toward solution unquestionably is to free the cotton growers as quickly as possible from

(*Concluded on page* 309)



Hospital ships for the transportation of the wounded, being towed along the upper Spree river

Floating Hospitals of Europe

Complete in Every Detail, These Vessels Accomodate the Wounded of Naval Engagements

By Dr. Alfred Gradenwitz

WHILE most people have at least a general idea of the organization and working of the sanitary corps of a modern army, few ever stop to think what may be the lot of those wounded in naval battles, how they are removed to places of safety and subsequently cared for.

It is a well-known fact that every soldier carries a little package containing all the requisites for an emergency dressing. In a similar way, there is everywhere on board warships an ample supply of dressing material close at hand, and though there are special ambulance men always available, each member of the crew has been trained in the rudiments of sanitation and is fully able to undertake first-aid treatment of his comrades.

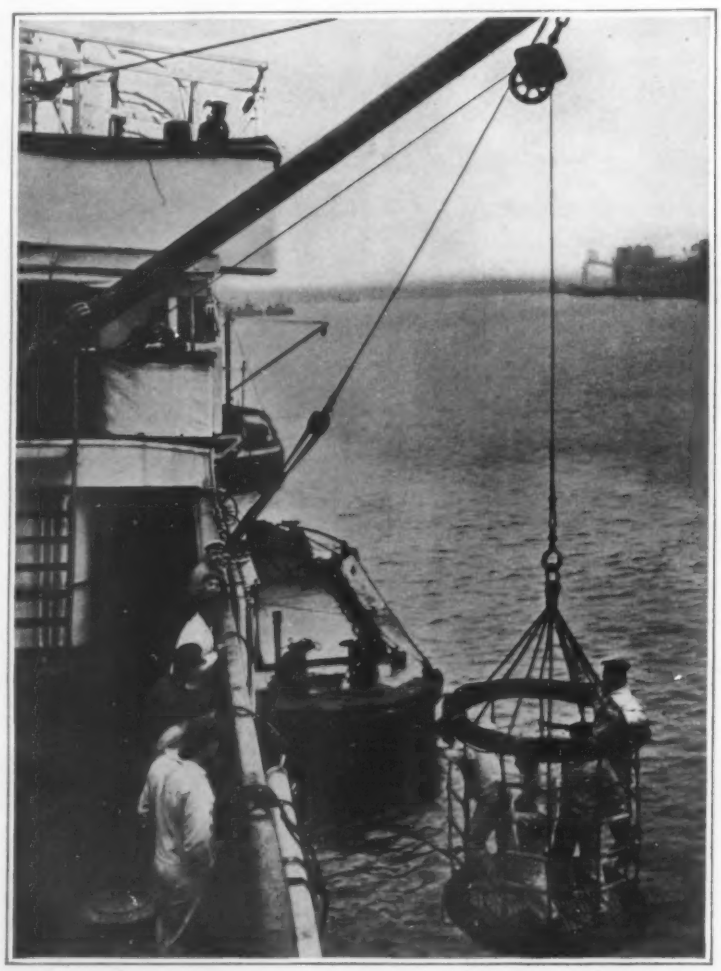
While a naval battle is in progress, the wounded must obviously be sheltered, as far as possible, from the enemy's projectiles. Accordingly, they are taken to special ambulance rooms in the lower part of the vessel, which are lighted and ventilated by artificial means. The ambulance rooms are supplied with everything required in modern surgical practice—operating tables with special mountings for the absorption of the vibration existing on warships, sterilizers for the dressing and instruments, oxygen-chloroform apparatus, and other similar equipments. In fact, patients brought to these rooms are not only examined thoroughly and treated with anaesthetics, but they are also, in urgent cases, dressed up in the most approved and precise manner.

When the battle is over, the wounded can be taken to the regular hospital rooms situated in a less sheltered position, provided the enemy's fire has left these intact. These rooms include baths and a chemist's shop, aside from the wards. The chemist's shop also serves as a chemical and microscopical laboratory.

Only the wounded whose cases are not serious are allowed to remain in the hospital rooms of the warships until fully recovered; those who are seriously wounded being transferred to special hospital ships at the first opportunity.

The hospital ships are large passenger steamers fitted up with every imaginable comfort and rearranged wherever necessary to meet all requirements of sanitation, so as to constitute real floating hospitals. Each of these vessels, in time of peace, accommodates about 2,000 passengers, and since they are now arranged for about 300 beds, it is obvious that the patients have an abundance of air and space, far more, in fact, than would be required for hygienic reasons. The berths for the wounded are not arranged one above the other as is generally the case on shipboard, but instead are placed side by side and in rows as in any hospital. Moreover, they are set up in such a way as to be free to some extent from the vibration of the ship, special berths with vibration-proof suspension being provided for the wounded who are dangerously ill. The windows are situated high above the water line so as to insure unlimited access to the sea air and sun.

On the "Sierra Nevada," a hospital ship of the North German Lloyd, the hospital rooms extend the entire width of the vessel, on two upper decks. Smaller rooms, arranged so as to be isolated from the remainder, are set apart for those suffering from infectious diseases; while still other rooms are destined for the insane, for the dangerously ill, and for the officer patients, respectively. The bright and spacious operation rooms on the uppermost deck are of special importance and are connected with smaller rooms for the narcosis, exchange of dressing, and other kindred functions. An X-ray laboratory, a very necessary part of a modern hospital, is also provided. Since wounds of the jaws are so frequent in modern warfare, the dentist's task is of much importance, and a complete outfit is provided for his work. Adjoining the department of internal disease are a chemist's shop and the room for electro-therapeutics, medicinal baths, and the like. Special toilet and bath rooms, as well as lavatories, are provided for each department, while the section devoted to the treat-



One of the salvage equipments of the German hospital ship, the "Sierra Nevada"

The x-ray room of a German hospital ship

A corner of a ward aboard a German hospital ship

ment of contagious diseases includes a disinfecting plant.

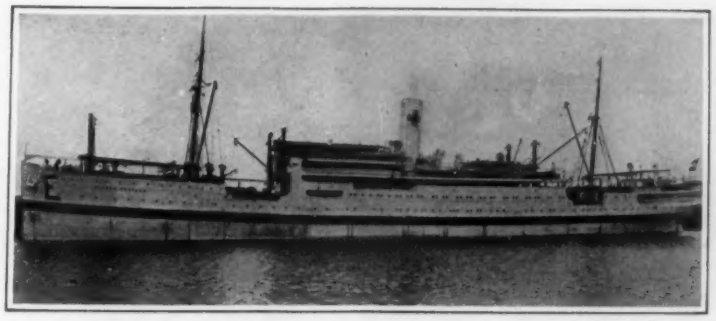
The food on board a hospital ship is excellent. The kitchen installations are most extensive and comprise storage and refrigerating rooms. Of almost equal interest are the washing and ironing rooms, as well as the repair shops for medicinal instruments and patients' dress. Finally, there are two libraries, for the patients and doctors, respectively.

The hospital vessel is supervised by a chief physician under whose orders there are three surgeon-majors and several assistant surgeons in charge of the various departments. The personnel includes a chemist, a dentist and the required ambulance and Red Cross men. The maritime direction of the ship is left in charge of the captain and the same officers who have control of the ship in time of peace.

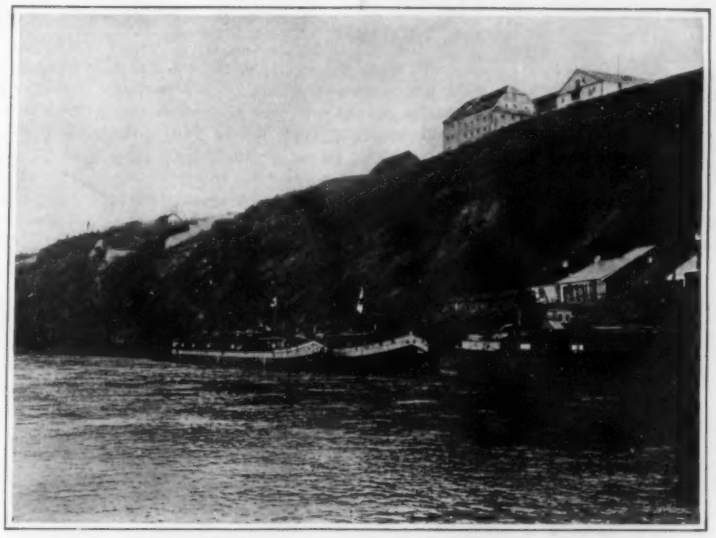
The most complete and diversified equipment of salvage devices is provided for rescuing the shipwrecked, permitting 1,000 persons to be picked up. An especially suitable device for this purpose is presented in one of the accompanying illustrations. The first thousand having been taken on board, the work of succoring the unfortunates can be continued with the same outfit, the vessel accommodating many thousands.

Quick working outfits—comprising derricks, blocks and ropes—are provided for taking patients on board or disembarking them. Elevators facilitate travel between the different decks and levels inside the vessel.

Apart from hospital ships proper, there are transport ships for transferring the wounded from war ships to hospital vessels. Finally, there are river vessels for the transport of the wounded, and wherever possible this method of transportation is resorted to in order that the wounded may be saved the fatigue of a railway journey.



The "Sierra Nevada," hospital ship of the North German Lloyd



German hospital ships for the transportation of the wounded on the Vistula river, in Russian Poland

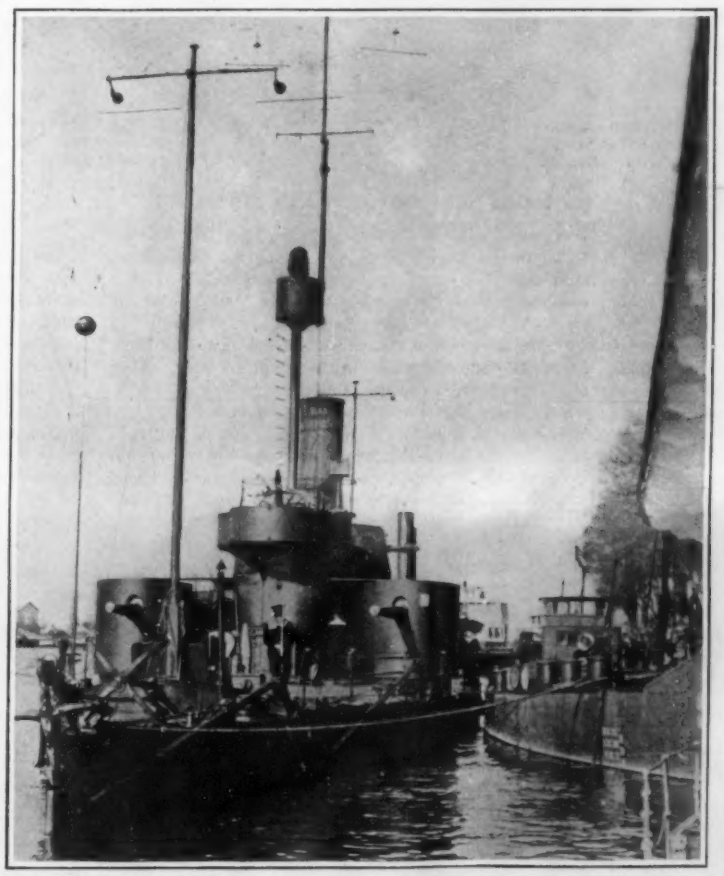
Austrian Gun Boats on the Danube

By Frederick von Pilis

ALTHOUGH the character of the naval war in the Adriatic has been such as to present no opportunities for the active use of the major units of the Austrian Navy, as represented by the four dreadnoughts of the "Unitis Viribus" class, and those fine semi-dreadnoughts of the "Erzherzog Karl" class, the smaller craft of the destroyer and submarine type have been very active and, as the list of disasters to the enemy shows, have proved to be very efficient both in themselves and in their handling.

There is one type of war vessel, however, in the Austrian Navy, which, although it has been occasionally mentioned, has not received full credit for the work it has done. This is the gunboat of the "Scamos" and "Koros" classes of 448 tons displacement, and the "Bodrog" class of 460 tons displacement. The vessels of the "Scamos" and "Koros" classes can steam up-stream at a speed of 12 knots, and the "Bodrog" and her sister ship can make 16 knots up-stream, against the powerful current of the Danube. These interesting vessels which, because of their low freeboard, might almost be said to belong to the monitor type of war vessel, carry each two 12-centimeter rapid fire guns, one on either beam forward, one 12-centimeter howitzer and two machine guns. They carry an armor belt 50 millimeters in thickness and the guns are protected by shields which are 75 millimeters in thickness.

This little fleet of vessels, designed specially for service on the Danube, has rendered excellent service in the war. It cleared the way for the passage of the Austrian Army over the Danube, closed it to the Servian troops, and after the battles of Semlin and Metrowica destroyed the Servian transports. The fleet also has rendered practically impossible the transportation of arms across the Danube by the Servians.



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Austria maintains a fleet of these gunboats on the Danube, which has done good service in the war against Servia. They mount 2 12-centimeter rifles behind shields, a 12-centimeter howitzer, and 2 machine guns. The belt armor is 50 centimeters and the shields are 75 centimeters thick.

The Austrian Gunboat "Bodroc"

Protection from Lightning

EVER since Benjamin Franklin invented the lightning rod our ideas as to what constitutes effective protection for buildings have undergone constant revision. The cheap and improperly installed lightning rods sold to farmers by enterprising agents were soon found to be worse than useless, and, in the reaction that set in against them, the modern dwelling house has usually been left without any protection. This has developed a situation that is both critical and serious, because we are now building our houses in such a way as greatly to increase the hazard that existed heretofore.

The modern skyscraper seems to have worked out its own salvation, because it is constructed on correct principles. Its massive steel frame, its metallic roof, and its grounded conductors form a lightning protection that is as perfect as could be desired.

In the modern suburban house, on the other hand, we are persistently violating the principles that have made the skyscraper so safe, and the increased damage that has resulted abundantly testifies that we are paying the penalty for such infraction of Nature's laws. Houses of the class mentioned are seldom provided with metallic roofs. Shingles, slates, and asbestos shingles are the predominating materials, and the leader pipes frequently terminate several inches above the ground. These things in themselves, however, do not constitute the increased hazard to which reference has been made. This comes from the steam or hot-water heating system, where we construct within the shell of the building a system of massive conductors running from cellar to attic. These pipes are, for the most part, very straight, forming paths of low impedance to the passage of high-frequency discharges, and they are also directly connected to the underground piping of the water-works system, which forms a most effective "capacity ground." A more attractive path for a lightning discharge it would be difficult to imagine, and yet how can the lightning take advantage of it? *Only by puncturing the roof or side-walls of the building and probably setting them on fire!*

The author has seen so many buildings damaged in just this way that he is moved to point out the danger, and to suggest as a remedy that such a heating system should be provided with at least one, and, preferably, several pieces of pipe extending from the top floor radiators straight up through the roof and terminating with capped ends. It would seem, from careful consideration of the various factors involved, that the danger will, by this expedient, be greatly lessened.

Japanese Tissue as a Photographic Paper

A NOTABLE contribution to photography has recently been made by the invention of a process of sensitizing the delicate hand-made Japanese tissues with a rapid emulsion for contact printing and enlarging by artificial light. The usual proceedings in sensitizing photographic papers is to coat the paper first with emulsions of baryta and gelatin, and subsequently with the light sensitive emulsions consisting mainly of nitrate of silver and gelatin carefully prepared.

The difficulties encountered in treating papers of such delicate structure as the Japanese tissues with the necessary emulsions mentioned above, are that the tissue curls and crumples to such an extent that it is useless for any commercial purpose.

Recently an inventor has succeeded in treating the tissue with the baryta and sensitive emulsion in such a manner that the paper is strong during the manipulations of developing, fixing and washing of the print. It will dry, between blotters, in about twenty minutes, and remain flat and flexible, retaining the rich, velvety surface characteristic of the Japanese tissues, and the pictures produced on that paper are rich in quality and extremely beautiful; any tone suitable to the picture is obtainable by placing one or more delicate-colored papers beneath the photograph or roughly coloring the mount, lending the print an effect similar to colored etchings.

For the commercial man with his large cases of bulky photographs, the Japanese tissue lessens the bulk with a marked difference, besides making a much finer display.

It is highly adaptable for decorative purposes, lending itself most readily for transparencies, lamp shades, etc., producing pleasing subdued effects. It is so tough that it may be wet and crumpled like a wash rag and yet be restored to perfect condition.

The Heavens in October

Brightness of the Moon's Light; How and Why it Varies

By Prof. Henry Norris Russell, Ph.D.

As the sun drops southward in autumn, the full moon—which is always in the opposite region of the heavens—rides higher and higher in the sky each month, and the light seems, and, indeed, really is brighter. It is in the clear nights of late autumn and winter that we find the moonshine that seems "as bright as day"; and, indeed, the light of a full moon, high in the sky, is quite sufficient for finding one's way in open country. It is only when we get under cover, or into the woods, or when we try to read by moonlight, that we realize that the brightest moonlight falls far short of daylight of the feebliest and cloudiest sort.

But our most vivid perceptions of the difference are not likely to save us from surprise when we first learn the results of actual measurement of the relative brightness of sunlight and moonlight. The light of the sun is *more than half a million times* greater than that of an average full moon—about 550,000 times, according to the most reliable investigations.

The brightest possible full moon, when at her very nearest distance, is 470,000 times fainter than the sun, and the moon three days from the full sends us less than a millionth part as much sunlight.

Probably no one would ever have guessed from his general impressions that the disproportion was anything like so great. There is a good reason for this—namely, the extraordinary range of sensitiveness and the adaptability of the human eye. Our eyes are perfectly reliable under the full glare of the noonday sun, and suffer no injury from the light reflected from an ordinary landscape—though the more intense glare from mountain snow-fields may cause them trouble.

In moonlight a million times fainter, these same eyes serve us as efficient guides across the same landscape,—and this is by no means the limit of their capability. When we inquire what is the faintest light which, showing on a white surface in a dark room, will be visible at all, experiments show that the light of the brighter stars is sufficient to be distinctly visible, after the observer's eyes have been well rested in the dark. This faintest visible illumination is more than 200,000 times fainter than full moonlight, and is no less than one hundred thousand billion times less than full sunlight. No artificial optical instrument can even remotely approach this enormous range of effectiveness.

Results which are almost equally remarkable, though less startling, are obtained when measures are made of the brightness of the moon at different phases. The half-moon looks half as big as the full moon, and one would suppose off-hand that it ought to give us half as much light; but the measures show that it actually sends us not quite one ninth as much light as the full moon. Similar conditions exist at other phases; for example, the gibbous moon, two days and a half after the first quarter, shows a visible illuminated area which is three quarters of the full circle; but it is only one quarter as bright as the full moon. The crescent, two and a half days before the first quarter, appears to have one quarter the area of the whole circle, but it sends us less than one thirtieth of the full moon's light.

Measurement of the brightness of the planets Mercury and Venus, which alone come into such positions that we can see them in the half-moon or crescent phases, show that their light behaves in a similar way. Mercury, over the range of positions in which we can observe it, behaves almost exactly as the moon would do in his place. For Venus the phenomenon is less pronounced; her brightness at the half-moon phase (after allowance has been made for the variations in her distance from the Earth and Sun) being one quarter that of the full phase.

Such curious facts arouse a lively desire for their explanation, and in this case reasonable explanations are at hand. The relative faintness of moonlight compared with sunlight ceases to be remarkable after a simple calculation, based on the sizes and distances of the sun and moon, shows that, even if the full moon reflected back to us all the sunlight which fell upon her, she could not send us more than one fifty-thousandth part as much light as the sun does. Since the actual light of the full moon is but one eleventh, even of this, it follows that the moon reflects only about 9 per cent of the light which falls on her—the remainder being absorbed, and transformed to heat on the lower surface. This may seem a low reflecting power, but it corresponds roughly with that of ordinary gray rocks, and so is entirely consistent with the idea that the moon's surface is composed of rocks like those with which we are familiar on the earth.

A part of the falling off of the moon's brightness as she departs from the full phase is explained by the fact that at the half-moon, for example, the sun's rays strike the most conspicuous portions of her surface obliquely, and are so spread out over them that they do not light them up as strongly as at full moon. Calculation shows that this might account for the half-moon's being one third as bright as the full moon, instead of one half; but this fails by a great deal of explaining the moon's observed behavior.

A reasonable explanation of the discrepancy may be found in the known roughness of the moon's surface. How this acts can be understood by anyone who has ever looked along a "broken road" of clean but trampled snow, when the sun was low.

Under the sun, the broken road shows as a dark track across the smooth white waste on either side. Face about, away from the sun, and it seems a bright track, whiter than the untrodden snow around it.

The reason is fairly obvious. The snow in the road is broken up into irregular lumps and balls, while that on each side is smooth. When we look toward the sun, we see the shaded side of these lumps, while the sun's rays are reflected from the smooth unbroken surface; hence, naturally the road looks dark. In the opposite direction we see the sunward side of the lumps of snow in the road, and since these face the sun almost squarely, they look brighter than the smooth surface upon which the sunlight falls very obliquely.

Now let us apply the same principle to the moon, whose surface we know to be covered with mountains or hills. When the moon is full, we are looking down the track of the incident sunlight (or very nearly so), and can see no shadows; for at the center of the disk the sun shines vertically on the moon, and even abrupt crags cast no shadow, while near her apparent edges, where the mountains cast shadows, they are behind the mountains themselves, and concealed by them.

But the farther we get out of the line between the moon and sun, the more we will see of the shadows. On the moon, where there is no diffused sky-light, the shadows are exceedingly black, and their existence darkens the average of the surface in exact proportion to their extent. When the moon is a crescent, and we are looking at her in a direction almost opposite to that in which the sunlight comes, we must see the shady side of every hillock, and it is no wonder that her light appears so faint.

The visible shadows of the lunar mountains, however, could hardly account for so large an effect as is observed. To explain it fully we must suppose that much, if not most, of the moon's surface is covered with masses of broken rock, in whose interstices shadows are formed, far too small to be seen by us singly, but betraying themselves by their combined effect.

When we consider the great changes of temperature to which the surface of the moon is subjected, which may well shatter the surface rocks, and the absence of those agencies which on earth cause fragments of rock to decay into sand or clay, this hypothesis seems very plausible.

The behavior of the other planets can be explained in a similar way. Mercury must have a surface about as rough as the moon's, while Venus, for which the effect is far less pronounced, is in all probability much smoother.

Before leaving the subject of the moon's brightness it may be well to explain that the reason why winter moonlight is so much brighter than moonlight in summer is that, the moon being higher in the sky, the rays have to pass through a smaller thickness of air, and suffer less absorption. In our latitude, the full moon in mid-summer is rarely seen at an altitude of much over 20 deg. above the horizon, and under these circumstances more than half her light is lost by atmospheric absorption.

At 11 o'clock : Oct. 7.
At 10½ o'clock : Oct. 14.
At 10 o'clock : Oct. 22.

At 9 o'clock : Nov. 7.
At 8½ o'clock : Nov. 16.
At 8 o'clock : Nov. 23.

At 9½ o'clock : October 30.

NIGHT SKY: OCTOBER AND NOVEMBER

The Heavens

Our map shows clearly what stars we may hope to see in the evening hours. The great square of Pegasus is so high in the south as to seem nearly overhead. East of it we find the little triangle of Aries, and below this the Pleiades, and the V-shaped group of the Hyades, in Taurus, and, still lower, Orion is rising. Perseus and Auriga are in the northeast with Andromeda above them. The Great Bear is low on the northern horizon, with the Little Bear and the Dragon above, and Cassiopeia still higher. Cygnus, Lyra and Aquila form a fine group in the west. The southern constellations—Capricornus, Aquarius, Pisces and Cetus, are comparatively very dull, but relieved by the brilliant presence of Jupiter.

The Planets

Mercury is an evening star at the beginning of the month, and is visible for a few days in the twilight though too far south to be conspicuous. Then he draws in between us and the sun, and passes through inferior conjunction on the 22nd, to reappear as a morning star early next month.

Venus, having passed superior conjunction in September, is theoretically an evening star, but is too near the sun to be seen without a telescope.

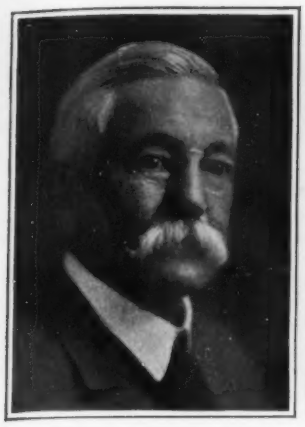
Mars is a morning star in Gemini and Cancer, rising at midnight when the month begins, and nearly an hour earlier at its close. Jupiter is in Pisces, and comes to the meridian about 10 P.M. in the middle of the month, so that he is very well observable.

Saturn is in Gemini, and is in quadrature west of the sun on the 10th. He rises a little before 11 P.M. and is visible till dawn.

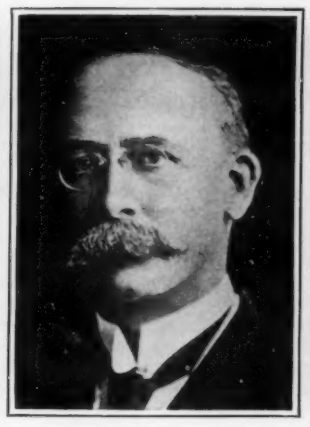
Uranus is in Capricornus, coming to the meridian about 8:20 P.M. on the 1st, and 6:20 on the 31st. Neptune is in Cancer, not far from Mars, with whom he is in conjunction on the 11th, and is observable in the early morning.

The moon is in her last quarter at 5 A.M. on the 1st, new at 5 P.M. on the 8th, in her first quarter at 10 A.M. on the 15th, full at 7 P.M. on the 22d, and in her last quarter once more at 11 P.M. on the 30th. She is nearest us on the 27th, and farthest off on the 11th. While passing around the zodiac, she comes into conjunction with Saturn on the 1st, Mars on the 2d, Neptune on the 3rd, Venus on the 9th, Mercury on the 10th, Uranus on the 16th, Jupiter on the 19th, Saturn again on the 29th, Neptune on the 30th, and Mars on the 31st.

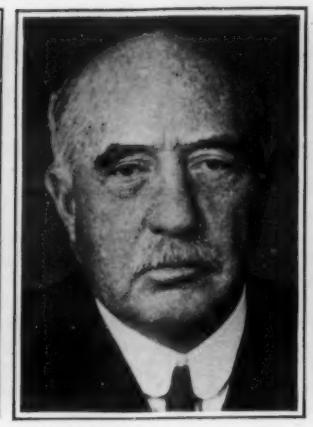
Princeton University Observatory.



Robert S. Woodward
(Am. Math. Soc.)



Prof. Arthur G. Webster
(Am. Math. Soc.)



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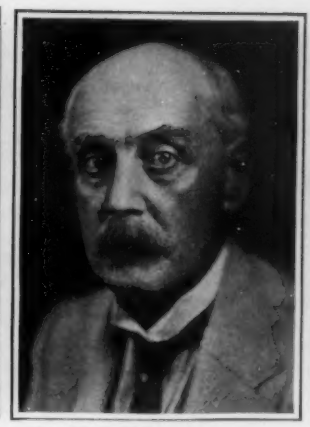

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Andrew M. Hunt
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Peter Cooper Hewitt
(Inventors' Guild)

The Naval Advisory Board of Inventions—I

A Brief Biographical Summary of Its Membership

MENTION has already been made of the board of prominent technical and scientific men that the Secretary of the Navy has appointed as advisers in relation to inventions that may be of service to the Government, and it is generally appreciated that every one of these gentlemen has, in his own affairs, had wide experience in considering inventions, not only those originated by himself, but by others, for many years, and there is every reason to believe that this board will not only be most competent to offer advice, but will be eminently fair in its proceedings, a matter that is fully guaranteed by the standing of the members.

As it will be remembered the men constituting this board were selected on the recommendations of a number of the leading technical associations in this country, each of which proposed the names of two members considered to possess the requisite qualifications for the discharge of the important and delicate duties to be delegated to them; and to enable our readers the better to judge of these matters for themselves and to make evident the excellence of the selections the following brief biographies are given.

That Thomas Alva Edison should be selected as chairman of the board is eminently fitting, both on account of his remarkably wide experience, which includes a multitude of different subjects such as few men have ever attempted to undertake, and because of his personal reputation. Born in 1847 in Milan, Ohio, his education was entirely self-acquired, and in his early years he took up the occupation of a telegraph operator; but his predeliction for scientific and technical matters, and his wonderful aptitude for solving intricate problems in those directions soon called him to other fields, and his subsequent history is well known. His early interests were naturally in the direction of improving telegraphic apparatus, and some of his early inventions related to multiplex telegraphic transmission; but his field of activity constantly widened, and he has made notable improvements, to mention only a few, in the phonograph, electric lighting systems, storage batteries, the telephone, the aerophone and moving pictures. In all of his work he has not only been a prolific inventor, but an intense and close student of modern improvements in many directions, which has given him a wide experience in estimating the value and utility of inventions, and this, added to his wonderfully diversified information, should make his judgment on inventions of peculiar value.

The American Mathematical Society nominated to the board Professor Robert Simpson Woodward, of

Thomas A. Edison, Chairman

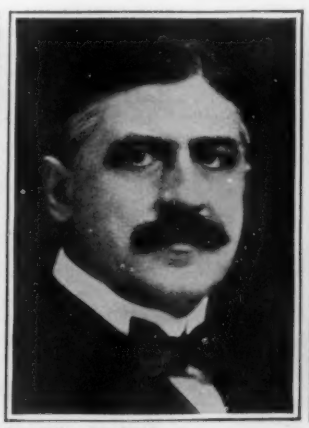
Washington, D. C., and Professor Arthur Gordon Webster, of Worcester, Mass. Prof. Woodward is an engineer and an astronomer. He was born at Rochester, Mich., in 1849, and took his degrees as Civil Engineer and Doctor of Philosophy at the University of Michigan, and has received other honorary degrees from the Universities of Wisconsin, Columbia and Pennsylvania. He has served as assistant engineer in the U. S. Lake Survey, assistant astronomer in the U. S. Transit of Venus Commission, astronomer of the U. S. Geological Survey, and has served in the Coast and Geodetic Survey. He was Professor of Mechanics, Physics and Mathematics at Columbia University, and has served as President of Carnegie Institution and as an officer of a number of scientific societies. He is an authority on mathematical physics and other branches of science. Prof. Webster is Professor of Physics at Clark University, Worcester, an institution distinguished by the excellence of its faculty. He was born at Brookline, Mass., in 1863, and graduated at Harvard University, after which he spent much time in advanced studies in Berlin, Paris and Stockholm. He is a high authority on physics, and a member of many learned societies.

The American Society of Civil Engineers selected Alfred Craven and Andrew Murray Hunt as being eminently qualified for seats on this Advisory Board. Mr. Craven is widely known on account of his long connection with various branches of municipal engineering in New York city. He is a son of Rear Admiral Thomas C. Craven, and a nephew of Alfred W. Craven for many years Chief Engineer of the old Croton Aqueduct. He was born in Bound Brook, N. J., in 1846 and graduated from the U. S. Naval Academy. After serving a year he resigned with the rank of Master, and took up his life work as a civil engineer, first on the California Geological Survey. Later he did considerable irrigation work and practiced his profession in Virginia City, where he established an enviable reputation as a mining engineer in connection with the development of the celebrated Comstock mine. In 1884 he became Division Engineer on the new Croton Aqueduct. He has held a number of important positions in the engineering work of New York city, and in 1910 became Chief Engineer of the Rapid Transit Commission of New York. In his public connections he has established a reputation for stalwart honesty, and his opinions on all engineering questions are held in high esteem on account of his wide experience and accurate knowledge of technical matters. Mr. Hunt is a resident of San Francisco, where he occupies a prominent position in his profession as an engineer. He is a graduate of the U. S. Naval Academy of 1879, and has had wide experience in steam and gas plants, as well as in hydro-electric developments, in which branches he has had much experience.

The nominations of the Inventors' Guild were Peter Cooper Hewitt and Thomas Robins, both well and favorably known to the public. Mr. Hewitt was born in New York in 1861 and graduated from Stevens Institute as a mechanical and electrical engineer. He also holds an honorary degree of Doctor of Science from Columbia. He is best known for his inventions of the electric rectifier and the light which bears his name, but has done very extensive research work in practical electricity, in which he is an acknowledged authority. He is a member of a number of learned societies and has held offices of trust. Thomas Robins is a resident of Stamford, Conn., where he is engaged

(Continued on page 312)

Thomas Robins
(Inventors' Guild)



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America As Her Own Chemist

First National Exposition of Chemical Industries Discloses Great Strides Made in Manufacture of Chemicals and Equipment

THE resourcefulness of Americans in manufacturing new products and devising novel processes is again forcibly demonstrated; this time it is in the form of chemicals and chemical equipment heretofore supplied by Germany, but now unavailable from that former purveyor of the world's manufactured chemicals and dyes, because of her commercial isolation.

The remarkable advance made in the production of chemicals and dyes in the United States during the past twelve months was much in evidence at the First National Exposition of Chemical Industries held in the Grand Central Palace, New York City, during the week of September 20th. Not only chemicals and dyes, but also the many requisites of laboratory equipment, heretofore supplied almost exclusively by Germany, were prominently featured.

In a general way the exhibits were divided into three main classes: First, chemicals, ores, metals, dyes, drugs, paints and other manufactured products of similar nature; second, apparatus and equipment for chemical laboratories, and third, machinery and equipment for manufacturing chemists, the treatment of ore and other purposes.

The fact that the United States depended almost wholly on Germany for many of the chemicals and dyes employed in the leading American industries attached the greatest interest to the displays of domestic manufacturers of chemicals and dyes. According to one of the exhibitors engaged in manufacturing dyes, previous to August 1st of last year Germany was supplying close on to 95 per cent of all the dyes employed in the United States. And not only did the Teutonic manufacturers enjoy a monopoly in the finished products, but they controlled the supply of benzol and other chemicals essential to the making of dyes. American firms supplying the five per cent portion of the United States dye consumption were obliged to purchase their raw materials from Germany, for the reason that it was then considered unprofitable to compete with the Germans in producing the raw materials because of the higher wage scale existing here.

The advent of toluol produced by the Rittman process came at a critical moment to the American dye producers. Many of them purchased large quantities of this chemical and it was indeed fortunate that they did, since the British Government has recently contracted for the entire output of toluol of the leading American producer for a period of several years. The price paid by the British Government is far beyond that offered—or could possibly be offered—by dye makers. However, it is believed that others will soon be producing the chemical for home consumption.

So it will be appreciated that the exhibits of the dye manufacturers were of particular interest, displaying as they did long rows of containers filled with dyes of varied colors. The American-made chemical products also shared the keen interest of the visitors, since the commercial possibility of successfully replacing German chemicals was considered doubtful by many.

The metallurgical exhibits were generally in the nature of displays of ores and the products and by-products of refining, all of which were highly interesting from an educational standpoint.

Numerous were the chemical apparatus and laboratory requisites exhibited, many of which were quite conventional, while a goodly portion were novelties just developed to the marketable stage. Among the most prominent of the novelties were the following:

A direct-reading specific gravity balance known as the "gravitometer" for solids, pigments or other finely divided materials which are insoluble in water, requiring no calculations nor the use of weights; the Riche Adiabatic Calorimeter which renders possible the exact determinations of caloric and combustion contents of coal, coke, heavy oils, food and other products because of its vacuum-cup feature which prevents intercommunication of outside and inside temperatures; a workshop microscope that may be used for examining the exterior or surfaces of metal products and which is provided with a miniature electric lamp to illuminate the surface that is being examined; the Fleming Combustion Apparatus for rapidly and accurately determining the amount of carbon in all grades of steel by direct combustion; the "High-Temp" furnace operating on commercial electric power circuits and producing temperatures up to 1800° C., the resistor element consisting of a special mixture of granular material which can be renewed occasionally; the "Tapalog" apparatus which is essentially a recording galvanometer and can be used for making permanent records of certain performances of machinery, such as the variation of the heat of a furnace; the Banks' generator for producing hydrogen-sulphide gas and possessing the advantages of portability, absence of odor, precipitation under constant pressure which can be regulated at will, definite means of ascertaining when precipitation is complete, and the elimination of loss due to bubbling; the Freas electric conditioning ovens for the determination of moisture in textile materials; and, lastly, an analytical scale which eliminates all small weights and beam riders, using instead a platinum or gold chain that may be varied to alter the weight by the simple turning of a thumb screw.

Laboratory glassware and porcelain ware is now being manufactured in the United States and it is claimed that the domestic products compare favorably with those of German manufacture, although it is admitted that the imported Jena glassware is still superior to any so far produced. Made-in-America glassware and porcelain ware were shown in abundance.

Among the exhibits of machinery and equipment for manufacturing chemists was a most interesting installation of smoke precipitation apparatus. Black smoke issuing from a smokestack was immediately dispelled upon the passing of current from a 100,000-volt transformer through the wires arranged at the mouth of the smokestack. Not only ordinary black smoke, but dust from smelters and refining furnaces, acid mists, dust from grinding and buffing machines, zinc oxide fumes from brass casting shops and other undesirable forms of smoke can be precipitated by electricity.

Other exhibits of this nature were centrifugal separators of many different kinds for clarifying or filtering precipitates or solids from a containing liquid, or for the separation of two liquids of different specific gravity. There were also exhibited electrostatic separators for the sorting of ore, based on the principle of like charges repelling and unlike charges attracting each other, steam jacketed kettles and vacuum pans, agitators, evaporators, furnaces and caldrons, vacuum drying apparatus, impregnating apparatus, vacuum pumps, digesters, percolators, water purifying equipment, enamel-lined tanks, pots and pipes, lead and tin-lined iron pipes and fittings, filter presses, rotary vacuum filters, rotary pressure filters, rotary thickeners or clarifiers, rotary hopper dewaterers, pyrometers and electrical equipment employed in the chemical and metallurgical industries, kneading and mixing machines, huge castings for chemical and metallurgical plants, concentrating mills for handling ore, and other machinery and equipment of similar kind.

Not the least impressive and instructive displays were those of the United States Government Departmental and Bureau Exhibits, occupying a large floor space. The United States Department of Commerce, Department of Foreign Trade, displayed its numerous bulletins and consular reports which are proving so valuable in the extension of American trade to over-sea markets. The Bureau of Soils exhibited a large collection of soils and fertilizers together with brief data as to their characteristics and merits.

Modest, although not the least interesting, exhibits were those graphically telling of the utilization of waste cherry pits, raisin seeds and apricot pits. The products obtainable from these heretofore discarded materials are little less than a revelation. For instance, from the 1,600 tons of cherry pits produced annually, 448 tons of kernels are obtained, which in turn produce approximately 235,000 pounds or 21,000 gallons of syrup, 5,000 gallons of alcohol, 685,000 pints of jelly, 300 tons of meal, three tons or 6,000 gallons of volatile oil, and 134 tons or 268,000 gallons of fixed oil. Equally striking is the utilization of waste raisin seed. The annual yield of these seeds is anywhere from 3,000 to 4,000 tons. Approximately 550 to 740 tons or 96,000 to 128,000 gallons of syrup is obtained therefrom. There is a yield of 41,000 to 54,000 gallons of alcohol made from the syrup. Approximately 340 to 460 tons or 90,000 to 120,000 gallons of fixed oil is obtained after the extraction of the syrup. Paints and soap can be made from the oil. Tannin extract, suitable for the tanning of leather, is obtained after the extraction of syrup and fixed oils, in quantities of 330 to 445 tons. From 1,600 to 2,200 tons of meal is obtained after the extraction of syrup, fixed oil and tannin extract. Lastly, the utilization of apricot pits is of equal interest to those of the cherry pits and raisin seeds.

The annual output of apricot pits is in the neighborhood of 5,000 tons. The apricot kernels from these amount to 1,250 tons. Fixed oil is obtained in quantities of from 350 to 400 tons, and volatile oil in quantities of from 18,000 to 22,000 tons. From 640 to 740 tons of meal is also obtainable.

A miniature Rittman process apparatus commanded no little attention, due to the recent introduction of this discovery which came to the rescue of American dye makers at a very critical moment. With this process, gasoline, benzol and toluol are produced.

The exhibit of the Bureau of Mines consisted of the most recent safety appliances employed in American mines. There were shown the Draeger, Westphalia, Fleuss and National smoke protectors and respirators for mine rescue work, as well as various types of apparatus for the resuscitating of persons overcome by gas, smoke or electric shocks, prominent among which were the pulmotor and lung motor.

The Department of Geological Survey exhibited a collection of economic minerals recently studied and described, numerous photographs, and the bulletins recently issued by the Department. There was also exhibited a complete field set for determining the ash in coal, weighing but 34 pounds complete and contained in a case measuring 11 x 13¾ x 14 inches. This set has been designed to meet the needs of field parties of the U. S. Geological Survey and permit of ash tests with a possible error not exceeding two per cent. A few of the more important pieces of this set are folding scales and weights, sieves, crucibles, spatula, brushes and tweezers, triangle pipe stems, mortar and pestle, gasoline blow torch of special design, tin boxes for samples, lead foil, thermometer, and an air bath or drying oven of heavy, polished copper. A portable still used by the U. S. Geological Survey for making field tests on oil shales was also exhibited.

The many uses to which wood may be put, aside from its conventional employment as lumber, comprised the leading feature of the Department of Forestry exhibits. In an effort to substitute other wood for spruce which is now being consumed at the alarming rate of about one and one-quarter million cords annually in the production of one and one-quarter million tons of newspaper stock, the Forest Service Groundwood Experimental Station at Wausau, Wis., recently experimented with other wood pulp with interesting results. Fourteen different samples of paper were produced and printed on by the New York *Herald* and St. Louis *Republic*. Each sample of paper was composed of twenty-five per cent hemlock sulphite and seventy-five per cent groundwood of the following species: Spruce, white fir, balsam fir, Engelmann spruce, California lodgepole pine, Noble fir, Sitka spruce, Alpine fir, Tamarack, lodgepole pine, Amabilis fir, western hemlock, western yellow pine and red fir. Samples of these papers, both plain and printed, were on exhibition.

Specimens of osage orange wood were exhibited as well as samples of tin mordanted and chrome mordanted wool dyed with osage orange, together with samples of chrome tanned leather dyed with osage orange extracts. Mexican (Vera Cruz) Fustic was also shown, accompanied by samples of tin mordanted and chrome mordanted wool dyed with it.

Domestic osage orange of Texas and Oklahoma has been found to contain the same dyeing principles as foreign fustic. The northern-grown osage orange does not contain the dye in commercial quantities. From 25,000 to 50,000 tons of usable osage orange is now obtainable in the United States. The wood contains ten to eleven per cent of tannin and this feature is now being investigated commercially as a source of tanning extracts. Specimens of Jamaica Fustic as well as wool dyed with it were also shown.

Distillation of hardwood produces many commercial products of value. The wood in the form of cordwood is heated to 750-800 deg. Fahr. in special retorts. The crude distillate on refining gives acetate of lime, wood alcohol and tar, while the residue in the retorts is charcoal. Over one and one-quarter million cords of wood were distilled in the United States during 1914. An average cord will yield nine to ten gallons of alcohol, 170-200 pounds of acetate, 15-25 gallons of tar, and 48-52 bushels of charcoal. Several important industries are dependent upon these products for their raw materials.

The extraction of resinous wood also yields many products of importance. Stumps or other "fat" waste of longleaf pine are treated by this process. The wood is first reduced to chips, producing wood turpentine and pine oil. The chips are then treated with hot petroleum in order to obtain a low grade rosin.

(*Continued on page* 312)

THE WORLD'S RECORD LOW GEAR RUN

"THE life of the average motor car," says a writer from the war zone, "is less than thirty days." Not referring to destruction by shot and shell, but to wear and tear —the inability of the car to hold up under hard service over rough roads.

Here for the first time, the automobile world is finding out what happens when a motor car is driven by men who cannot spare a thought for the car but only for the *service* they get out of it.

The biggest problem the motorist faces today is *wear and tear* and *depreciation.*

Last year these two items alone cost the car owners of America $400,000,000.

Your average owner hesitates to demand from his car all the service he has a right to expect. He is always *favoring* the engine, the tires, the complex system of parts and plumbing.

Taking all possible care, he still faces an unreasonable *depreciation.*

Car owners, patient and a bit timid at first, are asking in more insistent terms than ever —*What will the car do and what will it cost in upkeep and depreciation?*

How many motorists have ever seen a Franklin Car in the Used Car Dealers'—or offered in the Sale and Exchange columns of the Sunday papers?

Franklin cars built in 1902 and 1903 are still running.

860 MILES in Low Gear.
J. W. McCormach started from Walla Walla Wash. in a Franklin Touring Car on Sunday morning Aug 1st at 6th to drive to San Francisco Cal all the way in Low Gear - The high and intermediate gears have been removed and the transmission sealed
WHEN will he Arrive?
860 MILES ON LOW GEAR

Here is the hardest test an automobile was ever put to—a practical demonstration of what a Franklin Car can do, and of the great efficiency of Franklin Direct-Air-Cooling. At 5.50 o'clock on Wednesday afternoon, August 4th, this Franklin Car arrived in San Francisco at the finish—after a run of *860 miles on low gear* from Walla Walla, Washington, *all the way without once stopping the engine. High and Second gears were removed* from the car, and the *transmission sealed* before the start; and the car officially inspected and affidavit made by technical observers in San Francisco. Running time, 83 hours and 40 minutes—*over 10 miles an hour.* The route was the hardest possible, and was purposely chosen as an additional test of the dependability of the Franklin Car—through the John Day River Gorges, the Harney Desert in Southern Oregon, the Siskiou Mountains and the Burney Pass in California.

Two things are responsible for the long service life of the Franklin Car—The Franklin System of Direct-Air-Cooling, and the Franklin Scientific Light-Weight.

The Franklin Direct-Air-Cooling System *does away with 177 parts*—piping, pump, gears and fittings—the weight of water, the danger of freezing in Winter, of boiling in Summer, of bursting pipes, leaky radiator and cracked water jackets.

Scientific Light-Weight means first of all a critical selection of materials.

For the Franklin alloy steel we pay a *premium* of fifty per cent, to obtain the highest quality.

The *vanadium cast iron* in Franklin cylinders costs ten per cent more than the gray cast iron commonly used.

Owing to the grade of steel, Franklin springs cost *fifty per cent* more than the usual automobile springs.

The *laminated wood sill* of the Franklin costs fifty per cent more than the typical steel frame—but is *stronger*, lighter, more resilient: adds to the flexibility and comfort of the car.

If you have owned and operated any make of motor car, you have some first-hand experience with repair costs and depreciation.

The Franklin Facts about long service life can be obtained from any Franklin dealer.

Get them. They mean more to you today than ever.

FRANKLIN AUTOMOBILE COMPANY
SYRACUSE. N. Y.

The American Patents of

VISLOK Safety Lock Nut

Are For Sale

VIBRATION spells danger. The security of machinery, automobiles, steel construction—everything held together by bolt and nut—depends on the inseparability of that bolt and nut under a working load. A loose connecting rod may ruin a car—a single disconnected nut may destroy valuable and intricate machinery.

There has been a crying demand for a simple nut that will give a rigid, **locked-to-stay-locked** embrace to the bolt. That nut has arrived.

Vislok has been adopted by leading British concerns such as—

The British Admiralty — **Victoria Falls & Power Co. Johannesburg**

London Gas Light & Coke Co. — **The Blackpool Tramways Co., Ltd.**

among many others

What is Vislok?

Engineers say Vislok is an innovation. It is a new method of interlocking the nut with the bolt by causing the two threads to embrace so tightly that the lock not only is perfect but also has a tendency to become even **tighter** when under strain.

1. **Vislok will fit any standard bolt**—whether old or new. It is self contained and can be locked in any position on the bolt.
2. Vislok is a single lock-nut of twin formation—the two parts are capable of rotation but cannot separate—and has a solid continuous thread.
3. Vislok is made of bright drawn mild steel to standard dimensions.
4. Vislok is easily applied, locked or removed with an ordinary wrench.
5. Vislok has no loose or auxiliary parts and nothing to damage the bolt thread. It can be used and re-used indefinitely.
6. Initial cost is the only cost.

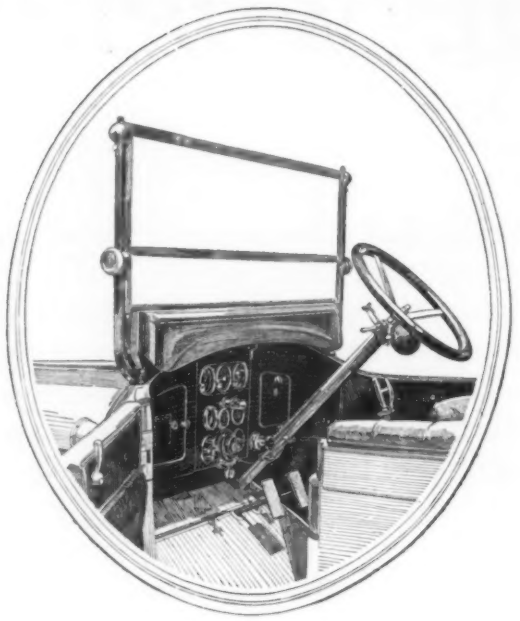
You are invited to investigate Vislok

Vislok has brought wealth to its English Patent holders. Think of its possibilities to American engineers, machinists, railroads, automobile and cycle manufacturers, miners, shipbuilders, etc. After every shadow of doubt, as to the almost phenomenal possibilities of Vislok, has been removed from the minds of engineers in the leading centers of the world, its patent rights for the United States of America are offered for sale.

A representative of Vislok, Ltd., is now in the United States and will be glad to arrange for appointments with interested men.

To meet this representative—to see Vislok—to have it demonstrated and fully explained—to learn the proposition of its owners communicate with

VISLOK, Ltd. c/o J. Roland Kay
723 Advertising Bldg., Chicago, Ill.



Pierce-Arrow

The control is simple and convenient. A touch of the finger or foot starts or stops the motor. Spark and throttle may be operated without taking either hand from the wheel. The driver sits at the right, the safe and correct position for American rules of the road.

The Pierce-Arrow Motor Car Company Buffalo, N.Y.

MURAD

THE TURKISH CIGARETTE

That MURADS are

Better than many 25 cent cigarettes

is NOT a mere claim

Murads ARE better—because better, higher-priced tobacco goes into Murads.

Much of the tobacco used in many 25 cent cigarettes could never get into the Murad brand. These facts are perfectly well known among cigarette manufacturers.

We Challenge Contradiction

Don't pay 25 cents for a cigarette whose price is the only expensive thing about it. A half dozen puffs will show how much betten Murads are.

Amaryros

Makers of the Highest Grade Turkish and Egyptian Cigarettes in the World

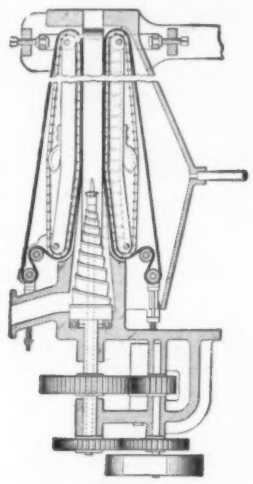
FIFTEEN CENTS

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

COTTON SEED PRESS.—W. McC. NEALE, 479 W. Washington St., Greenville, N. C. This invention relates to the extraction of oil from seeds, such as cotton seeds, and one of the main objects thereof is to move said seeds through a gradually constricted passage con-

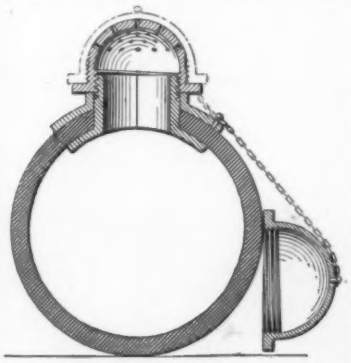


COTTON SEED PRESS.

tinuously by the movement of the walls of said passage. It provides means for adjusting said walls to any desired degree of angularity, to correspondingly effect the degree of inclination of the walls with respect to each other and to the passage formed thereby.

Hardware and Tools.

SPRINKLER.—H. E. HOUSTON, Box 127, Amarillo, Tex. This invention has reference to devices employed more particularly for sprinkling lawns, and the object thereof is the provision of a simple, convenient and inexpen-

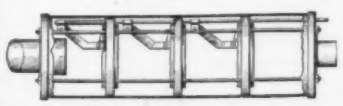


SPRINKLER.

sive device which can be easily and quickly attached to a garden hose, and which device has simple means for placing the same into operative or into inoperative position.

Of General Interest.

APPLIANCE FOR MEASURING AND COMPUTING HEIGHTS AND DISTANCES.—R. R. MILLER, 1324 Fitchland Ave, Toledo, Ohio. The construction of the appliance is rugged, portable, not easily put out of adjustment, but easily understood, and gives results sufficiently accurate for the use of woodsmen, sportsmen, wiremen, prospectors and others who wish an



APPLIANCE FOR MEASURING AND COMPUTING HEIGHTS AND DISTANCES.

approximate measure of the heights of trees, wires, projections, hills and the horizontal distance to a point directly below some point on the hillside and similar measurements which cannot readily be made by direct measurement with a tape line or other ordinary method unless regular surveying instruments are resorted to.

REINFORCEMENT FOR PIPE INSULATION.—W. B. GRAY, 1327 South 22nd St., Louisville, Ky. The inventor provides a device for use with pipes having insulating coverings, too soft to hold its form under the weight of the pipe which it covers, and adapted to be connected with the pipe and to be arranged between the pipe and a support of the character shown and described in his co-pending application, Serial No. 851,222.

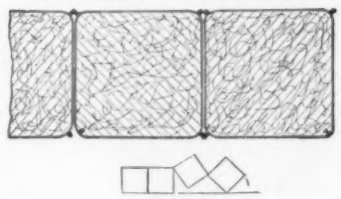
PLANT AND FLOWER STAND.—A. T. CHALK, Homewood, Baltimore, Md. This improvement is constructed with special reference to lightness, cheapness, durability, and adaptation for detachment or dissociation of its parts or members for the purpose of storage or transportation in compact form. The stand may be of various sizes, circular, semi-circular or angular.

HOSE RACK.—W. MCCLINTOCK, 1992 Belmont Ave., Bronx, N. Y., N. Y. Among the objects of the invention is to provide a hose rack adapted for paying out the hose therefrom either loop by loop or all in one mass, according to the location of the fire with respect to the stand-pipe, or with respect to obstacles which may be interposed between the fire and the stand-pipe.

MEANS OF ESCAPE FROM SUBMARINES.—W. J. KENELY, 142 Broadway, Elizabeth, N. J. The invention provides for a submarine boat substantially watertight compartments adjacent the top or any other convenient wall of the structure in which all or any number of the occupants of the vessel may congregate in the event of accident or disaster incapacitating the propelling or controlling means for the vessel, and from which such occupants may set themselves free from the stranded vessel and float to the surface of the water in life preservers or otherwise.

Household Utilities.

MATTRESS.—G. E. LACKEY, 138 South 7th St., Burlington, Iowa. This invention provides a device wherein the mattress is composed of a series of similar connected sections, each section being square in cross-sections and having its four sides of equal size, and wherein the



MATTRESS.

sections are connected in such manner that all of the sides of the sections may be used. In the engraving it is shown from right to left that the first and second sections are connected at their lower corners, while the second and third are connected at their upper corners.

BROOM.—W. P. NEWELL, Horton, Kan. This broom effects considerable saving to the consumer by not alone doubling the life thereof by the provision of the two operative ends, but also providing a rough broom for rough work and a fine broom for finer work, and correspondingly increasing the life of the broom by the conservation of the finer ends.

Machines and Mechanical Devices.

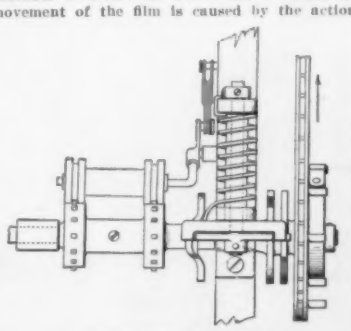
AUTOMATIC GATE.—A. WILLIAMSON, Monticello, Ark. The invention relates generally to automatic gates, and more particularly to that type of gate which is designed to be operated by road-side mechanism depressible under the weight of vehicles and pedestrians, so as to both open and close the gate when passing the same in either direction.

WIRE STRETCHER.—J. L. MCFADDEN, Address V. T. Miller, Attorney, Ness City, Kan. This powerful device is for use in stretching wires, as, for instance, in fence construction or repair, wherein the mechanism is arranged in such manner that the operator may stretch the wire while standing at such a distance from the stretched wire that there will be no danger of injury in case of breakage or release of any of the parts.

CAMERA SHUTTER.—W. C. SULLENDER, 1918 Bacon St., St. Louis, Mo. One of the main objects here is to provide means for delaying or determining the moment of exposure without interference with the duration of the exposure, whereby the operator will have time to be included in the photographic picture.

Pertaining to Recreation.

MOTION PICTURE DEVICE.—P. J. TAYLOR, Cairo, Ill. An object of the inventor is to provide a device for intermittently driving the sprocket wheel which feeds the film. It provides a device in which the intermittent movement of the film is caused by the action



MOTION PICTURE DEVICE.

of a spring, thus making the movement quicker and preventing the flicker which is attendant with devices of this kind when the latter are run slowly. It also provides a device which obviates the necessity of using a cutting shutter when the machine is being run slowly.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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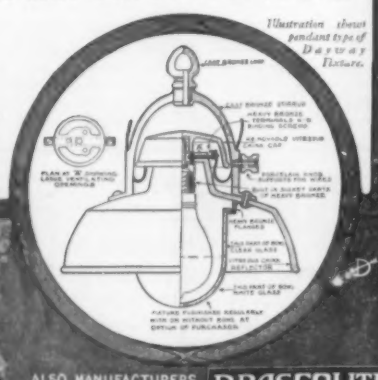
Illustration shows pendant type of Dayway Fixture.



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Stefánsson's New Found Land

(*Concluded from page 295.*)

The Crocker Land Expedition which set out to find the land that Peary thought he had seen from Cape Thomas Hubbard, is now on its way home after an unsuccessful quest. They pushed 130 miles northwest from Cape Thomas Hubbard, but found only open ocean. While the negative results of this expedition points to the conclusion that the new land of the Canadian Arctic Expedition may not continue far towards the northeast the possibilities of westward extension are not curtailed.

The track of the "Karluk" practically completes the drift record from Point Barrow in Alaska to Spitzbergen Islands north of Norway, two-thirds of the circuit around the pole. It ends at almost the same place where the drift of the "Jeannette" began, and this vessel, in turn, sank not far from the beginning point of the "Fram's" long voyage in the grip of the floe. All drifted to the west, but the "Fram" made more toward the north than either of the others. These certified tracts block in a vast area capable of holding a continent the size of Greenland or extensive archipelagoes.

Contrary to some published reports the new land north of Siberia found by Commander Wilkitzky, of the Russian navy, cannot possibly be part of the supposed land mass outlined above. The "Fram" drifted between this new land (Nicholas Second Land) and the pole, passing over an area of deep ocean soundings. The De Long Islands, near which the "Jeannette" sank, and the ill-defined mass of Bennett Land may mark the extreme extension towards the west of the supposed land in the Arctic Ocean.

The theoretic arguments for the presence of a great land mass in this position are very strong, as they have been presented by R. A. Harris, of the United States Coast and Geodetic Survey. Practically no tide enters the Arctic Ocean from the Pacific. From the North Atlantic there enter two principal streams. The force of the first of these by way of Baffin Bay is dissipated in the narrow passages of the Arctic Archipelago and very little reaches McClure Straits that open into Beauford Sea. The region north of Alaska is affected by the second stream which does not seem to cross the pole, but rather to follow the Siberian coast. This deflection points to a great obstruction.

But the search for new land constitutes only a small part of the progress of the Canadian Arctic Expedition, although it receives the lion's share of popular attention. The possibilities of valuable ethnological work were shown by Stefánsson himself in his earlier expeditions of 1906-1907 and 1908-1913, when he lived with the Eskimo and learned their language and thought. During these years he covered the arctic foreland from Point Barrow to Coronation Gulf, everywhere noting the limits of Eskimo tribes and the sites of ancient villages. It was in the eastern extension of this field work, along the shores of Coronation Gulf and Victoria Island, that he met large Eskimo groups who had never seen a white man and whose culture was uncontaminated by the outer world. The interesting tribe made famous by the term "blond Eskimo"—a vivid phrase of unguessed parentage and easy virtue—presents a difficult problem to the student of physical characters. It is not impossible that the occurrence of curly, light-colored hair and of bluish eyes in some individuals may mark an ancient admixture with European blood, and what more likely candidates for the honor of introducing this strain than the lost Scandinavian colonists of Western Greenland?

In ethnology Stefánsson has contributed greatly to our knowledge of native ideas and pointed the way for further study. He was first to explain the peculiar belief in the transmigration of souls from the newly dead to the newly born. The *nappan* or personal soul of the adult waits at the grave after death until summoned to become the *atka* or guardian

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PATENTS FOR SALE

The executors of the late Ernest Gustav Hoffmann, the well-known inventor, will sell the following patents issued to said Hoffmann, or his legal representatives in this country:

624,488, May 9, 1899, Machine adapted for making balls, rivets, etc.
624,489, May 9, 1899, Stop Mechanism.
624,490, May 9, 1899, Device for holding circular cutter.
624,491, May 9, 1899, Device for feeding wire
624,492, May 9, 1899, Drive Chain.
647,491, April 17, 1900, Worm Gearing
655,711, August 14, 1900, Thrust bearing for shafts.
669,927, March 12, 1901, Locking Device for nuts, etc.
708,228, September 2, 1902, Back pedaling brake.
729,586, June 2, 1903, Road vehicle.
738,445, September 8, 1903, Device for securing parts to shafts.
746,834, December 15, 1903, Motor Vehicles.
754,066, March 8, 1904, Telescopic joint for shafting.
771,637, October 4, 1904, Universal joint or coupling for shafting, etc.
796,649, August 8, 1905, Ball bearing (Hirth)
877,927, February 4, 1908, Annular Knife.
881,471, March 10, 1908, Method of manufacturing and assembling ball bearings.
887,093, May 12, 1908, Transmission gearing for automobiles.
896,208, August 18, 1908, Motor Vehicles.
899,534, September 29, 1908, Universal joint.
905,532, December 1, 1908, Truck for railroad cars.
930,600, August 10, 1909, Double thrust ball bearing.
1076,652, October 21, 1913, Driving mechanism for Vehicles
1129,036, February 16, 1915, Electric Motor.

Copies of these patents may be seen at the office of Alfred W. Kiddle, Esq., one of the executors, at 115 Broadway, New York City, from whom further information concerning the same may be obtained.

soul of the child. Children thus possess the supernal wisdom of one who has tasted life and death and they must not be checked in any of their desires.

The work of the southern or mainland party has gone forward rapidly. This represents research in established sciences such as biology, geology, zoölogy and authropology. The economic value of the coal and copper deposits of the far north is appreciated by the Canadian government. Chipman, O'Neill and Cox have carried on topographical and geological researches. Johansen has gathered much data on tides, Jenness has done ethnological and archeological work and Anderson has engaged himself in zoölogical studies.

The "Alaska" and "North Star" have been used to establish and maintain an eastern base near Coronation Gulf. It is apparent from Dr. Anderson's dispatches that the latter boat was deflected from her prearranged trip to the northern part of Banks Land because hope for Stefánsson had been practically given up. The "Mary Sachs" seemingly had orders to go no farther north than she did. It is well that such dangerous crossing of plans should be avoided in the future.

Polar exploration, or perhaps one should say exploration in general, has become a symbol of daring progress and of the spirit that makes for civilization. In the official account of nearly every great piece of exploration there are stories that are never told. The trials and isolation of any human group on the ice, the tundra, the desert, or the jungle bring to the surface defects of temperament and character ordinarily concealed under the veneer of polite society. Few men have the physical strength to brave the rigors of a frozen trail, and few have the mental poise to withstand the siege of winter in a lonely outpost. Judgment should be softened by charity when failure comes to expeditions under great trials of flesh and spirit. But all the more credit is due the successful ones, the generous and courageous hearts that overcome dreadful odds and wrest victory from black defeat. Surely Stefánsson and the men under him deserve every praise and aid that can be given them.

American Museum of Natural History.

Cost of the War In Airships

(Concluded from page 294.)

crash on the beach of Fanoe Island, snapping in two as she struck. Her crew of two officers and fourteen petty officers and men jumped out uninjured, and her skipper, Capt. Fritz, immediately set the airship on fire, as he said, "in order to prevent her from being blown further ashore and imperilling lives and adjacent buildings." It is more likely, however, that the commander of the airship acted according to instructions and fired his craft in order to prevent the Danish authorities from seizing her and learning the secrets of her construction. Nevertheless the authorities of Fanoe Island were successful in saving from the wreck the four engines and two machine guns, which were sent to Copenhagen, while the framework, weighing about 7 tons and valued at $10,000, was broken up and melted down. The crew was interned at Nordby.

The other airship that was lost the same day was the *L-4*, a Schuette-Lanz of 30,000 cubic metres capacity. She was returning south from a reconnoitering flight over the North Sea when she ran into bad weather, first meeting with fog and then heavy storms of sleet and snow. Soon afterwards two of her engines failed and the great airship, being already overloaded with a covering of snow, became so unmanageable that her commander, Capt. von Platen, decided to abandon her. When near land over the surf at Boersmose, near Baavand, on the West coast of Jutland, the men jumped from the airship. Two officers and nine petty officers and men landed safely, but one man who delayed taking the plunge fell from a considerable height and broke both legs. As soon as she was relieved of the weight of the greater part of her crew, the airship ascended and drifted seawards, carrying along four men who could not make their escape in time.

Those of the crew who landed safely made their way to the nearest coast guard station and were interned at Odense, but neither the *L-4* nor the four men she carried were ever heard from thereafter.

On February 26th a Zeppelin which had been delivered to the Austro-Hungarian Navy at the beginning of the month was wrecked by the storm off Pola and her crew perished in the Adriatic Sea.

March 1915

On March 5th the naval Zeppelin *L-8* was engaged over the French lines in Flanders by a squadron of two French and two British aeroplanes and slightly damaged through a bomb, which penetrated the airship's envelope and smashed some of her stabilizing fins. Although steering with difficulty, the airship attempted to escape through the pull of her powerful engines, but when over Tirlemont an explosion occurred on board and immediately the huge airship came to the ground and crashed into a group of trees. Nine members of her crew of 44 were killed outright and eight were so badly injured that they died on the following day. The airship was a complete wreck and had to be dismantled on the spot; her remains being placed on eighteen lorries and sent back to Germany.

On the same day another Zeppelin was lost in the North Sea. Her wreck was sighted floating off Wimereux by a Danish skipper, who stated that the airship bore the mark *L-9*. Some time later the loss of this airship was officially confirmed by a wireless report from Berlin, which said that the naval airship *L-9* was missing since March 5, when she had been bombing Calais, and that she was considered as lost.

April 1915

On the night of April 11-12 a Zeppelin, which apparently belonged to the military or *Z*-class, bombed the town of Bailleul, France, where the presence of British staff officers had been reported to the Germans by a spy. In fact, the bombs resulted only in the killing of five women. Upon her return journey the airship was heavily shelled by the Allied artillery while passing over Ypres, and damaged. However, the airship managed to reach the German lines and attempted to make a landing near Thielt. The landing miscarried, for the airship was thrown into a pine wood, near Aeltre, and wrecked. Eleven men of her crew of seventeen were killed by the impact.

May 1915

On May 13th a Parseval was accidentally destroyed in Belgium, being thrown by the storm into the Gierlesche Woods. Two of her crew were hurled out of the gondola by the impact of the landing and severely injured. The envelope was totally wrecked on the trees, but the gondola and the engines still proved serviceable and were sent by rail to the nearest German aerial base.

On May 18th two Zeppelins, which on the preceding day had raided Ramsgate and Dover, appeared at midnight over Calais and bombed the port. They were violently fired at, but escaped injury and flew off in the direction of Boulogne. When passing over Marquise, however, the French coast battery at Cap Gris-Nez opened fire on the invaders and succeeded in hitting one of them, which was disabled and fell on the beach at Fort Mardik, about two miles from Dunkirk. The crew of forty officers and men were taken prisoners by French marines, who had hurried to the scene of the disaster, while the wreck of the airship was washed away by the sea.

On May 21st a semi-official note issued at Koenigsberg, East Prussia, announced that a military airship had broken loose from her moorings and sailed westward without any crew aboard. News of her descent had to be sent at once to the governor of the fortress. Two days later a disabled airship was seen drifting over Odense, Denmark, in a westerly direction. Finally, on May 26th, it was reported from Friedrichshafen that a Zeppelin had foundered in the North Sea and

How An Incendiary Was Foiled In The Great Pabst Plant At Milwaukee

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that the fate of her crew was not known. This report probably referred to the airship which broke away at Koenigsberg.

June 1915

On June 7th the Zeppelin *LZ-37* was attacked in mid-air over Mont Saint-Amand, near Ghent, by a British airman, Lieut. R. Warneford. Climbing above his foe the airman dropped six bombs, one of which struck the airship squarely in the middle, whereupon she exploded and fell to the ground, hitting a convent and killing two nuns in addition to her whole crew.

The same day another Zeppelin, the *LZ-38*, was destroyed in her shed at Evere, north of Brussels, by two British airmen, Flight Lieutenants J. P. Wilson and J. S. Mills, R.N.A.S., who set the shed on fire with incendiary bombs. The German authorities first pretended that the airship shed housed only a Parseval; but this assertion was positively contradicted by a great many people who had seen a Zeppelin enter that shed the same morning. At the same time it was learned that the factory numbers of the two airships destroyed on June 7th were respectively *LZ-37* and *LZ-38*, and this made it possible to identify them with the Zeppelins that were launched at Friedrichshafen on April 3d and 24th, respectively.

This double catastrophe resulted in a great decrease, during the following month, in the activity of German airships; this accounting for the fact that no unit of the German airship fleet was lost during the month of July 1915.

During the same month Austria lost on the Italian front a Parseval airship, which was destroyed on June 14th by the storm, having been hurled against the Adamelo Peak (Trentino). The entire crew were killed.

August 1915

On the night of August 9-10 five German airships attacked the English East coast. One of them, a Zeppelin, was seriously damaged by the gun fire of the land defences, and upon her return fell into the sea off Ostende. The Germans succeeded in towing her into port, but soon a squadron of French seaplanes appeared coming from Dunkirk and subjected the Zeppelin to a persistent bombing, which first broke her back and finally blew her up. The greater part of her crew were killed or injured by this explosion.

A fortnight afterwards another Zeppelin was bagged and captured by the Allies, but this time on the Eastern battle front. The airship was flying near Vilna on August 24th, when a Russian field battery opened fire, hitting her four times and forcing her to make a landing. In addition to a crew of two officers and eight men, the Russians captured with the Zeppelin a machine gun, many bombs and air darts and photographic apparatus. The number of the crew permits of the conclusion that this Zeppelin belonged to the military class which, being somewhat obsolete, seems to be chiefly used against the Russians.

September 1915

During the first fortnight of September—where this record ends—Germany accidently lost a Zeppelin in Belgium. This airship was returning on September 8th from a reconnoitering trip and was about to land near Brussels, when she collided with the airship shed and was wrecked. The causes of this accident have not yet been elucidated; it seems to have been due to faulty steering. Four men of the Zeppelin's crew were killed thereby and a score injured.

Recapitulating, the Austro-German airship losses amounted up to September 15th to twenty-seven units, of which seventeen were Zeppelins and the remaining ten belonged to either the Gross-Basenach, Parseval or Schuette-Lanz class. Eight at least of the Zeppelins were of the naval or *L*-class, which displace 950,000 cubic feet and are propelled by four 200 horse-power engines furnishing a top speed of 55 to 58 miles per hour; each of these airships carrying one ton of explosives. The other nine Zeppelins belonged to the smaller military or *Z*-class,

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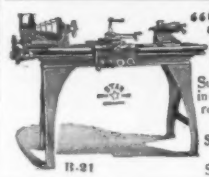

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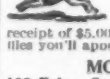

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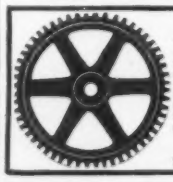

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which have a displacement of from 688,000 to 812,000 cubic feet with a power plant of from 540 to 600 horse-power, furnishing a top speed of from 45 to 50 miles per hour. These airships carry only about one-half ton of explosives.

Even considering the remarkable raids German airships and Zeppelins in particular have carried out during this war, the losses they have been subject to seem extremely heavy, although these losses have been more than offset by the marvelously rapid production of "Ersatz" Zeppelins or units of replacement. Since the outbreak of the war the working personnel of the Zeppelin Works at Friedrichshafen has been steadily increased by the addition of highly skilled mechanics, so that by the end of March last it numbered 2,000. This personnel, by working in day and night shifts, has turned out after April 1st one airship every fortnight, which would seem an extraordinary undertaking were it not known that presently the Friedrichshafen factory is solely used for assembling and inflating Germany's giant air cruisers. Indeed, the construction work is now entirely carried out by the Potsdam branch of the Zeppelin Works and by various other concerns which are building certain minor parts, such as the gondolas, the engines and the propellers; these are shipped in sections to Friedrichshafen, where they are speedily assembled.

Knowing the working capacity of the Zeppelin plants it is easy to figure out the number of airships that have left the yards up to September 15th, 1915. Till March 31st twelve Zeppelins had been completed at the rate of one every three weeks; since then the output was speeded up so as to attain the rate of one every fortnight, which gives eleven additional units, or a total of twenty-three airships to which must be added eleven Zeppelins that were in commission at the beginning of the war. If we now subtract from this grand total of thirty-four Zeppelins the seventeen units that were lost up to the date of writing, this would still leave Germany in possession of seventeen large air cruisers, half of which belong to a new type capable of carrying two tons of explosives. It is very likely that the Zeppelins which raided London in August and September belonged to the latter type.

TABLE SHOWING GERMANY'S AND AUSTRIA'S MONTHLY AIRSHIP LOSSES FROM THE BEGINNING OF THE WAR UP TO SEPTEMBER 15TH, 1915.

Month	Zeppelin Airships	Other Airships	Fate of the Crew
1914			
August	2	..	12 killed 12 prisoners
September	1	3 (2)†	81 prisoners*
October	..	..	..
November	1	1	?
December	..	2	?
1915			
January	1	1	16 killed 7 prisoners
February	2 (1)†	1	16 killed 27 interned
March	2	..	33 killed
April	1	..	11 killed
May	2	1	40 prisoners
June	2	1 (†)	23 killed*
July	..	..	..
August	2	..	11 killed* 10 prisoners
Sept. 1–Sept. 15	1	..	4 killed
Total	17	10	126 killed 138 prisoners 27 interned

† Austrian airship.

* Estimate based on the regulation crew of a naval Zeppelin (16), a military Zeppelin (12) and a Parseval (6).

Scientific Solution of the World's Cotton Problem

(*Concluded from page* 207.)

the slavery of custom, habit, the landlord and the merchant; enable the original grower to retain the title to his cotton until he can distribute and market it so as to always realize a profit over cost of production, leaving the greater portion of the surplus of any year, if there be a surplus, where he can see and utilize it as a check and guide to his planting. The experience of last year suggests how this part may be undertaken. If neither the

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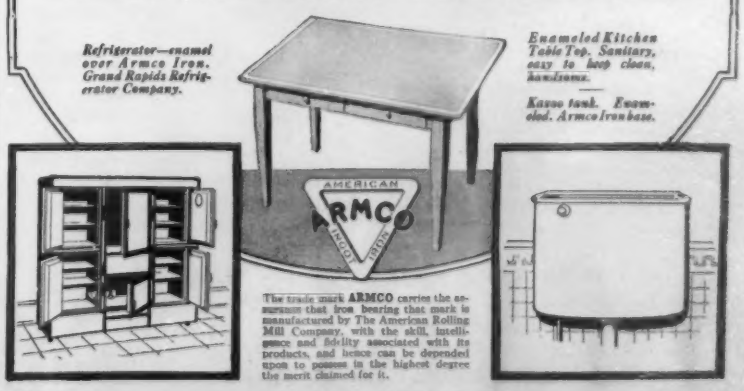

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charitable "Buy a Bale at Ten Cents" movement and the ineffective Bankers' Loan Syndicate at Six Cents had been attempted and instead the efforts and a very little touch of the philanthropy consumed in those movements had been put into what might be termed "a war cotton loan foundation to permit and encourage correct marketing of cotton by 'distressed cotton growers,'" and this foundation had loaned at legal interest to such original growers and such only on warehouse receipts of their own cotton for five bales at eight cents a pound—the average of the two figures of the other two plans—one bale to be sold say every three months and one-fifth of the loan and charges liquidated then and there, such loans would have paid out in full and in good money, besides constituting a valuable education in marketing, put into the hands of the distressed cotton growers with no taint of charity.

This year, right now, conditions of every sort have so changed for the better that the foregoing-mentioned plan might be successfully carried out with the foundation offering to lend the full market price of cotton on these terms up to ten cents a pound. German efficiency would jump at the chance to save its own country—and the neediest men in it—the product of the year's labor and teach such a wholesome lesson for the future at the same time to so many.

The second essential consists in enabling and teaching these freed cotton slaves who wish to remain free—and most of them do—to raise other crops as well as cotton, especially live stock, by furnishing them with proper and just credit for the purpose so that if they do nothing more they may at least oscillate from pasture to cotton field and ultimately raise that bale to the acre which they should raise.

These two essentials fulfilled, the first very properly the work of outside capital, tinged with a very little philanthropy, the second the work of bankers, merchants and landlords of the cotton states, we will witness an approach toward stability in cotton production and in prices of cotton such as we have never had before. Both call for immediate action and they are perhaps enough for immediate consideration. As to the future and the fuller solution of the problem let us go forward to what is possible some twenty-five perhaps even ten years from now.

The Complete Solution

The complete solution of the cotton growers problem will be when there are cotton barns on every cotton farm, in which the cotton may be carried in the seed, that is to say, unginned, and such arrangements made that the cotton shall be ginned as needed for consumption; the gins and the oil mills operating the whole year round as the cotton mills do. This will require an adequate rural credit system, both based on land and farmer's collective credits and imperishable products. It will also require a national warehouse law so that farmers in any community can avail themselves of their collective credit and borrow on their cotton, stored in their own warehouses or barns on their own land, with the same facility and at as low a rate of interest as manufacturers and merchants can now borrow on their products stored in their warehouses on their premises.

This, then, is the scientific solution of the world's cotton problem. Its inauguration would greatly cheapen the cost of production of cotton both in labor and in causing the cotton by-product, the seed crop, to bring its full share of profit. It would enable the cotton states to sell cotton to the world at a reasonable price without loss to the grower.

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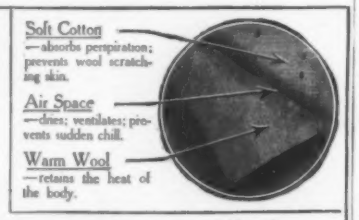

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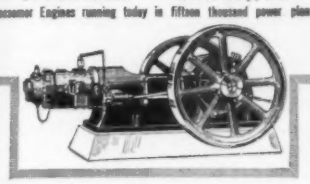

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The substance has been named Tree Tanglefoot because it has found quite an extensive use as a banding material for trees to prevent the ascent of injurious caterpillars or other insects, particularly gypsy and brown-tail moths, tussock moths, cankerworms, fall web-worms, ants, etc. It is also the best possible application after pruning or tree surgery. It will waterproof a wound or even the crotch of an old tree when nothing else will do it.

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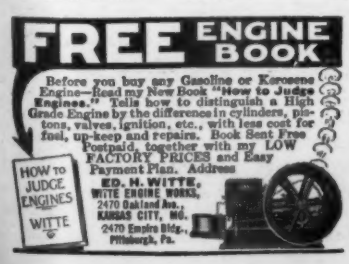

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granted for different periods, determined in each case by the government, and these terms may vary from one to twenty years. Ordinarily the term is limited to ten years, but patents of importance or patents requiring the investments of large sums of money, from twelve to fifteen years. The maximum period is twenty years under the law.

In the absence of any treaties between Chile and other nations on the subject of industrial property, any invention patented in foreign countries may be privileged in Chile at any time within several years after such invention has been first patented in other countries. The Chilean law requires only that the invention be unknown and not in use in Chile at the date on which the patent is applied for, and that the original patent granted to the inventor be still in force in the foreign countries.

Legal Notes

An Edison Patent Held Void for Lack of Invention.—In Edison et al vs. Alsen's American Portland Cement Works, in the United States Circuit Court of Appeals, Second Circuit, the Edison patent No. 802631 for an apparatus for burning Portland-Cement clinker was held void for lack of invention.

What Constitutes Patentability in a Design.—In Grelle vs. City of Eugene, Oregon, involving design patent No. 43338 for a five-light lamp, the United States Circuit Court of Appeals held that each separate element in a patented design was old does not negative invention, which may reside in the manner in which they are assembled; also the test of infringement of a design patent is whether the two designs viewed separately would appear to be identical to the eye of the ordinary observer; also held the Grelle design patent 43338 valid, but not infringed.

A Court Decision Affecting Union Underwear.—Justice Hough in the United States District Court for the Southern District of New York in the case of Horace G. Johnson and Henry S. Cooper vs. M. H. Lambert in giving a decree for complainants held the patent infringed. The first claim of the patent No. 973200 in suit reads as follows:

"An under-garment having a permanently closed crotch, and a posterior opening extending from a point near the waist-line to a point below the crotch in one leg only, substantially as described."

In the course of his decision, the Justice says: "I conclude that as long as producing a new thing by very simple means, constitutes invention, Johnson can claim that honor, and he ranks a good deal higher on the honor list than the makers of garters, neck-ties, and 'domes of silence,' who have of late years so impressed some courts."

New Use Discussed by Judge Kohlsaat.—In the case of the Hoskins Manufacturing Company vs. General Electric Company, wherein the Circuit Court of Appeals has affirmed the decision of the court below, and found the Marsh patent 811859 infringed. Justice Kohlsaat in rendering the decision illuminated the doctrine of new use. It seems the most pertinent reference affecting the validity of the Marsh patent was an English patent to Emile Placet, and the General Electric Company is said to have sought in its product to come under the Placet specification. Judge Kohlsaat said, "For eleven years this device of Marsh lay hidden as a gem in its Placet matrix. There it might yet be lying had not Marsh found it and made it public. Certainly it never occurred to Placet that this chromium-metal alloy would produce a rival to platinum as a resistance element at a cost and under conditions which made it an available article of commerce." * * * "Placet merely says chromium renders certain metal more resistant to high temperature. * * * At most he is speaking of externally applied heat, which is no criterion for durability under internally developed heat."

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Save 21 to 35% of Your Fuel Bill

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Engineers have always agreed that a heating boiler of 75% efficiency—a boiler using 75% of the heat in fuel—was as near perfect as possible.

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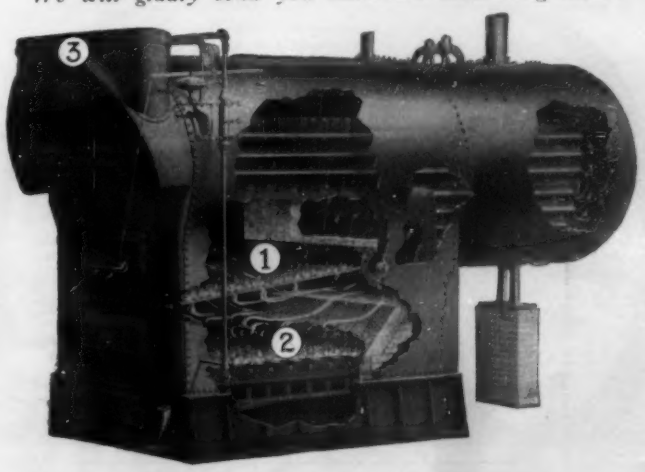
And this is how they do it:

The double-grate, down-draft construction of Kewanee Smokeless Boilers prevents any of the heat-giving gases from getting up the stack unburned. It cuts coal costs because it uses all of the coal for making heat. None of the fuel is wasted. And it eliminates smoke because smoke is nothing but unburned fuel.

Kewanee Smokeless Boilers are not new nor untried. In thousands of the best buildings, in all parts of the country, they are cutting coal costs by burning cheap soft coal smokelessly.

We will gladly send you literature describing them.



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Cushman Engines are used for a greater range of work than any other single 4-cycle engine on the market. Besides doing all stationary work as satisfactorily and economically as engines of any weight, they may also be attached to stationary or movable machines, such as Grain Binders, Hay Bailers, Corn Pickers, Potato Diggers, Concrete Mixers and Hoists.

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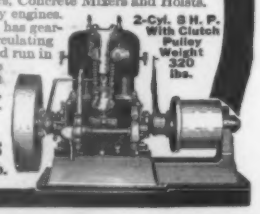

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A collection of essays selected from those submitted in the Scientific American's Prize Competition. With an introduction and editorial notes by Henry P. Manning, Ph.D. 5½ x 8¼ inches. Cloth. 251 pages. Illustrated. $1.50.

This work presents twenty essays from as many points of view, all of them interesting and no two quite alike. The reading of one essay does not involve the reading of the entire work, yet the entire book gives a comprehensive view of what the layman wishes to know about this subject.

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The Naval Advisory Board of Inventions—I

(*Continued from page* 301.)

in business. He was born at West Point, N. Y., in 1868, and is a graduate of Princeton. He is president of the Robins Belt Conveyor Co., which manufactures devices of his invention that are widely used, and is also secretary of the Inventors' Guild. He is a member of a number of technical societies and is an engineer and inventor of ability.

The American Society of Automobile Engineers is represented by Andrew L. Riker and Howard E. Coffin, both of Detroit. Mr. Riker was born in New York in 1868, was educated in the city schools and is a graduate of the Columbia Law School. He became interested in the question of the mechanical propulsion of vehicles, of which he made a special study, especially in relation to electric power. He produced one of the first electrically propelled vehicles in this country. His interest in mechanical propulsion naturally led him to the study of other kinds of power, and his work in gasoline engines, extending over many years, is well known to the automobile public. He was the first president of the Society of Automobile Engineers, and is the vice-president and chief engineer of the Locomobile Company of America. His influence in the development of the automobile has been notable. Howard E. Coffin is another engineer of prominence. He was born at West Milton, Ohio, in 1873, and received the degrees of B.S. and M.E. from the University of Michigan. After leaving college he was connected with the U. S. Civil Service for several years, when he took up the subject of internal combustion engineering. He was in charge of the experimental department of the Olds Motor Works for several years, and later chief engineer of the same company. From 1906 to 1908 he was vice-president and chief engineer of the E. R. Thomas Detroit Co., and later held the position of consulting engineer for the Chalmers Detroit Motor Co. Since 1910 he has been vice-president and consulting engineer of the Hudson Motor Car Co.

The American Society of Aeronautic Engineers added Henry A. Wise Wood and Elmer A. Sperry to the Board. Mr. Wood is a New Yorker of many activities, being best known for his ingenious inventions in machinery relating to the art of printing, for which he was awarded a gold medal by the Franklin Institute. He is a member of the Society of Naval Architects and Marine Engineers, besides other scientific and technical associations, and for a considerable period has been a student and writer on aeronautical subjects. Mr. Wood is in business, and is president of several manufacturing concerns. He was born in New York in 1865, and was educated in the Media Academy, at Media, Pa. Mr. Sperry is widely known on account of the remarkable stabilizing apparatus for aeroplanes which he has devised; but beyond this he occupies an eminent position as an electrical engineer, although his activities have by no means been confined to this branch, as he has made important inventions in electric brakes, internal combustion engines, electro-chemical apparatus, gyrostatic apparatus and in many other directions. Mr. Sperry was born at Cortland, N. Y., in 1860, and is a graduate of Cornell. He is connected with a number of manufacturing companies, and is a member of various scientific and technical societies.

(*To be continued.*)

America As Her Own Chemist

(*Concluded from page* 302.)

The extracted chips, when large enough, are still suitable as raw material for the making of wrapping paper. Over 100,000 cords of resinous wood was extracted in 1914 in the United States. A cord of 4,000 pounds will average from 8 to 12 gallons of turpentine, 2 to 3 gallons of pine oil and 500 to 800 pounds of rosin, while the extracted chips will make from 1,300 to 1,500 pounds of paper pulp.

Interesting uses of paper pulp were presented in the exhibits of artificial silk yarns, artificial cloth with cotton filling, paper cord with a hemp core, paper furniture braids and cord, paper cloth with cotton filling, crepe paper, paper rugs and paper rug yarns, artificial silk hosiery, twine and cord, and—perhaps most startling of all—viscose sausage casing.

Petrocine colors made from waste products of petroleum, now under investigation by the Bureau of Foreign and Domestic Commerce, were also exhibited. These colors are direct dyes for cottons, silks or wools, and are fast to light, washing, and other conditions.

The exhibit of the Bureau of Standards was most complete, not only in presenting the apparatus used in the laboratories of the Bureau, but also the chemicals, metals and ores recently tested.

Among the special apparatus shown were: Portable and stationary tenth cubic foot bottles used for testing laboratory gas meters; dry gas meters and wet gas meters; gas calorimeters and accessories; thermo-electric pyrometers; radiation pyrometers; the Holborn-Kurlbaum type of Morse pyrometer, in which a four-volt incandescent lamp is burned and is seen superimposed on the image of the flame of body being tested when looking through the eye-piece, the brilliancy of the lamp being varied until its filament appears to merge with the brilliancy of the article under test; clinical thermometers of which the Bureau tests about 15,000 annually; a number of different types of thermometers for laboratory purposes; a bomb-combustion calorimeter; a saccharimeter of the Bates type, and a Ziess refractometer for determining refractory indices for liquids, such as turpentine, linseed oil, butter fat, etc.

The section devoted to weights comprised exhibits of materials used or being considered for use in the construction of weights, as well as the construction of different types of weights. There was also a facsimile of one of the two prototype kilograms of platinum-iridium, which were constructed and certified by the International Bureau of Weights and Measures and allotted to the United States, being brought here by special messenger in 1890.

Other features of the Bureau of Standards exhibit were samples of ores, metals, and chemicals recently tested in the Bureau's laboratories, as well as approved and unapproved laboratory equipment, standard electrical cells and resistances, specimens of concrete affected by electric current, and pieces of steel and cast and drawn aluminum tested for tensile strength.

How to Drink from a Bubbling Fountain. "Bite the Bubble"

IF improperly constructed or improperly used, the bubbling drinking fountain may be a greater menace to health than the common drinking cup. The other day an inspector of the U. S. Public Health Service took a seat beside a bubbling drinking fountain in a railway station and watched the way in which it was used. Forty-seven different persons, of whom eleven were men, twenty-two were women, and fourteen were children, used the bubbling fountain. In almost every case the lips were placed almost completely around the metal ball from which the water spurted, and one small boy seemed as if he were trying to swallow it. Several of the men obviously were chewing tobacoo. Of the forty-seven people, four were colored, three looked as though they might have tuberculosis, and three had an eruption upon the face.

Every person using the bubbling drinking fountain should bear in mind that the object of this sanitary device is to prevent the interchange of mouth secretions. When mucous and other matter becomes attached to metal it sometimes requires considerable force to remove it, and this is not always accomplished by a slowly moving current of water. In using the bubbling fountain the rule should be "Bite the Bubble." The lips should not touch any part of the fountain, and under no condition should the fountain be used for rinsing the mouth or for expectorating.

Bossert Redibilt Home for the American Committee of Relief for Babies in Belgium, Long Beach, L. I. Erected in 18 hours.

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Built of Standardized Units—

each unit being complete and ready to erect—including five thicknesses of materials, and Bossert air-chambers.

This cuts down waste to nothing and cost of erection to 5 or 6 per cent of cost of building.

Any one can erect a Bossert Redibilt Home in a day or two—all parts come ready painted and fitted with fine hardware.

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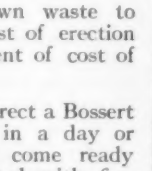

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NEW BOOKS, ETC.

SECRETS OF GERMAN PROGRESS. By Frank Koester. New York: The Fatherland Corporation, 1915. 8vo.; 396 pp.; illustrated. Price, $1.25 net.

Mr. Koester defends German bureaucracy as necessary to the fine-point efficiency of a nation that must make up by intensive culture and co-operation for poverty of resource and the pressure of competition. At the same time he declares there is more real personal liberty in Germany than in the United States. His fascinating story of Germany's rise to industrial power and internal prosperity holds many lessons for other nations, our own not excepted. Mr. Koester declares that the first cause of her greatness is a form of government so democratic in principle that the will of the people is swiftly imposed and almost as swiftly enacted. The American press generally, and our friend Vance Thompson in particular, come in for some caustic remarks, not altogether unmerited. Non-political administration and the ordered co-operation of science and industry are pithily discussed, as are the army, the navy, the educational system, and city planning. Present-day Germany is proclaimed pre-eminent in the arts, the sciences, and the humanities. Edison is dethroned in favor of Werner von Siemens; Bell was simply a copyist after Edward Reis. Our locomotives consume two or three times as much steam as those of Germany in performing the same amount of work, and we are told that we are hopelessly burdened with inferior machinery. It may, however, console us to learn that England is "the least progressive country," although in the same breath we are warned that we are rapidly retreating down the same hill. The author's exaggerations, though, are subordinate to a main body of sound reasoning and indisputable fact.

ELECTRICAL MEASUREMENTS AND METER TESTING. By David Penn Moreton, B.S., E.E. Chicago: Frederick J. Drake & Co., 1915. 12mo.; 328 pp.; 191 illustrations. Price, cloth, $1; full leather, $1.50.

As a new and up-to-date presentation of meter engineering, this should be appreciated by the practical electrician, for it avoids the extremely technical without falling into the error of inadequacy. Recent advance in this branch of electrical engineering has been rapid, but Prof. Moreton has kept pace with modern development while not slighting fundamentals. To these latter the first five chapters are devoted, leaving to the remaining eight the discussion of measurements, and the construction, operation and calibration of the instruments. The text is generously illustrated.

THE BUTTERFLY GUIDE. A Pocket Manual for the Ready Identification of the Commoner Species Found in the United States and Canada. By W. J. Holland, LL.D., Director of the Carnegie Museum. Garden City, N. Y.: Doubleday, Page & Company, 1915. 237 pp.; 295 colored figures. Price, cloth, $1 net; leather, $1.25 net.

"The Butterfly Guide" is dedicated to the Boy Scouts of America, and enables the young naturalist to identify readily more than 250 species of North American butterflies; these are depicted by the Guide in all their natural colors and, generally, in their natural sizes. The metamorphosis from egg to imago is interestingly described, and approved methods of collecting and mounting are placed before the student. Two indexes, one by common and the other by scientific names, materially aid in giving ready access to the contents of the manual. The process of printing in three colors from half-tone plates has made it possible to issue a moderate-priced work replete with illustrations of remarkable fidelity to Nature.

PORTO RICO PAST AND PRESENT. And San Domingo of To-Day. By A. Hyatt Verrill. New York: Dodd, Mead and Company, 1914. 12mo.; 358 pp.; with illustrations, maps, etc. Price, $1.50 net.

Porto Rico, notwithstanding the fact that it has been a colony of ours for sixteen years, is a sealed volume to the great American public. Few indeed could intelligently discuss its geographical location, fewer still its resources, its people, its occupations. In a volume in which charming description alternates with solid information, Mr. Verrill puts us in contact with the island's life, and we are surprised at the extent of its territory, the varied nature of its scenery, the luxuriance of its tropical vegetation, the perfection of its road and transportation systems, and the beauty of its architecture. A thrill of pride is excusable as we learn what American possession has done for this essentially Spanish and languorous place. Sanitation has banished much of the dirt and disease; electricity has installed adequate lights and telephones; the automobile hums along the alluring roads; and the school is an established institution. Much of the above applies also to San Domingo, the site of the first settlement of Europeans in the New World. Its close connection with Porto Rico makes its inclusion a welcome addition to the volume, which has the true appeal that only first-hand observation and enthusiasm can impart.

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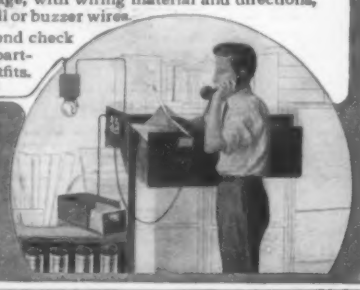

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(13085) N. M. W. asks: In hot countries, where ice is difficult to obtain, I understand water is cooled by means of a porous jar covered with a cloth (even when hung in the sun); that rapid evaporation is induced, and by that means the water is kept cool. Can you oblige me with a description of this cooler? A. The water cooler used in tropical countries, notably India, is simply an earthen jar unglazed—like a flower pot for example. It is therefore very porous. When water is put into this jar, it quickly penetrates the pores of the earthen jar and comes to the outer surface. Here, it evaporates and is replaced by more water from the interior. Thus, the evaporation is continuous. A portion of the heat necessary to evaporate the water is derived from the water in the jar, and thus, the water is made quite cool. If hung where the sun shines upon the jar, the evaporation goes on more rapidly and the cooling is brought about just the same as if the jar hung in the shade. The Hindus hang the jar under a veranda in the shade so that the wind blows over it, thus hastening the evaporation. The action depends entirely upon the porosity of the jar and the air blowing the vapor away as fast as it is formed. It is thus exactly like the cooling produced by fanning one's self. We should not cover the jar with cloth.

(13086) L. D. H. asks: A strange device for lighting illuminating gas comes to my attention. It is a metal cylinder, perhaps five inches long and just a little larger than a pencil, and within one perforated end is a loop of fine filament. A ferrule, sliding to close the perforations when not in use, is said to be necessary to prevent the "loss of strength" by the device. There is no evidence that the cylinder contains anything, and the thing is apparently not electric. Held in the stream from a gas jet, the filament is said to glow and kindle the gas. Can you tell me the principle of this device? I shall appreciate your courtesy. A. The fine filament in the little metal cylinder which you describe as a gas lighter is doubtless of platinum and has upon it some small pieces of spongy platinum. When held in a stream of illuminating gas the spongy platinum absorbs the gas and is by that act heated to a red heat and the stream of gas is set on fire. This property of spongy platinum is usually described in the text books of chemistry. The careful covering of the perforations in the tube with a ferrule when not in use is to prevent dust from accumulating in the pores of the sponge and thus destroying its power of absorbing the gas and acting as a gas lighter.

(13087) W. B. asks: What is the scientific answer to this apparently simple question? A balloon is sent up at New York city on an absolutely calm day, remains in the air for one hour, drifting in the moderate currents of the upper air, and descends a few miles from the place from which it was sent up. How is it that the place of descent is not some spot adjacent to Chicago, if the theory of the earth's revolution is correct? A. The simple answer to your inquiry about the fact that a balloon in a calm comes down near the place from which it went up is that the air is a part of the earth and rotates with it just as the water does. If it did not, there would be a tremendous wind from the east of nearly 1,000 miles an hour at the equator, and about 550 miles in our latitude. This is apparent if you recall the wind which is felt when going swiftly through still air on a car. The air is held upon the earth by gravity and constitutes a part of the revolving globe in a very real sense.

(13088) E. S. P. asks: In a layout for wiring a two-phase induction motor, I, a short time ago, showed a four-pole switch with the fuse clips for cartridge fuses at the top of the board—the live wires entering from the bottom. This was for a small horse-power motor, and my idea was that the switch, after it became loosened up, would always tend to remain open, instead of as in the inverted position, having gravity tending to close it. Was this position correct? And does it make any difference which side of the switch is fused? A. The position of your switch is correct. Single-throw switches should always be mounted so that gravity cannot close them, that is, with the handle and the blades turned downward to open. The Fire Underwriters Inspectors would not pass them if the handle turned down to close. The usual and best practice is to have the current enter at the top so that the blades will be alive and the jaws dead when the switch is open. This is because the blades present more surface and reach out farther than the jaws, so that there is more risk of accident with the blades alive. It makes no difference which side of a switch is fused so far as the current is concerned. Double-throw switches may be mounted horizontally and then gravity cannot close them, but it is better to place them vertically, and place a guard to prevent them from closing if the handle falls down. A switch may turn very tight at first, but the joints are certain to wear and the handle to become loose, so that it will fall down and close when it gets worn.

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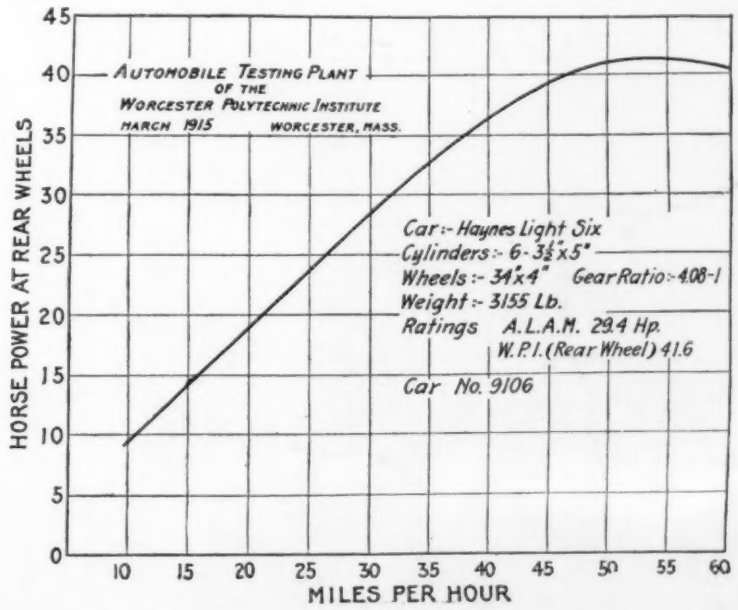

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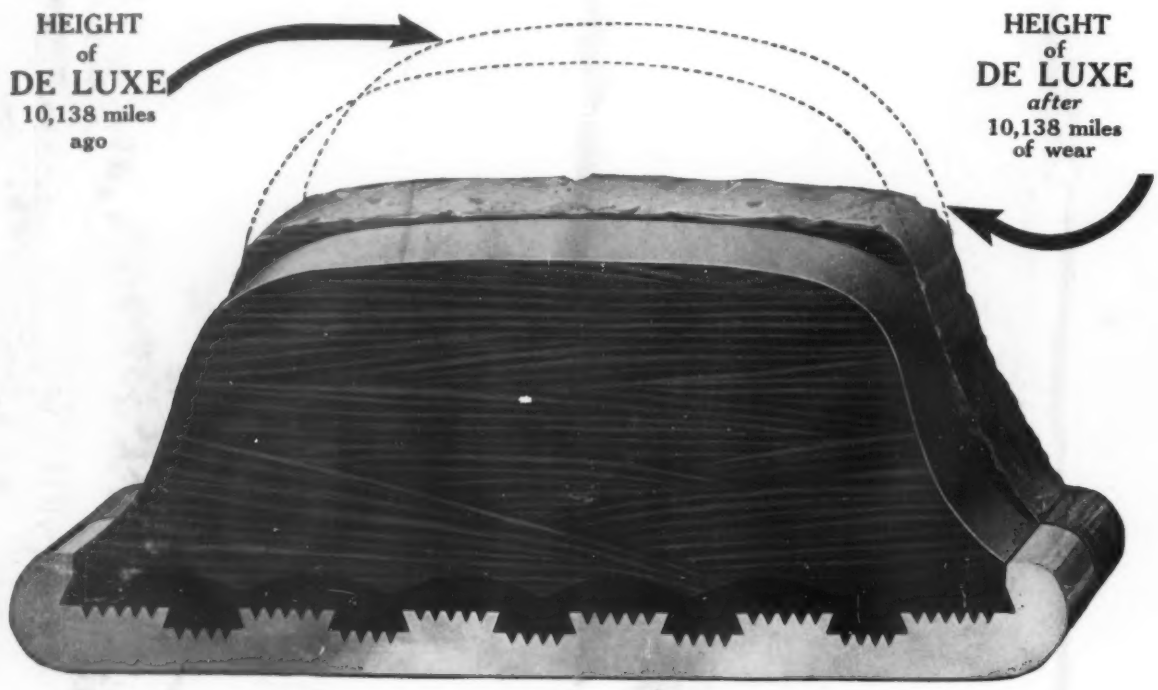

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